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Biological Determination of Radiation Dosage

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THE attempt to treat deep-seated neoplasm with highly filtered rays has lead to a realization of the fact that in order to obtain any permanent results, doses much larger than have previously been used must be given. Owing to the necessary limitation of the number of portals through which the exposures can be made, the dose which the skin receives must be terminated just at the point at which a slight erythema appears, or, according to some workers, in such excess of an erythema as is possible without producing irreparable damage to the skin. If this latter dose is in any way exceeded, very severe and even permanent injury to the skin may result. These statements are true, whatever type of machine is employed and are also true of any voltage which may be employed.

There is no evidence to show that the burns produced without a filter or with low degrees of filtration are any more severe than those produced by the use of thick copper filters and the highest voltages now obtainable.

The only point is that in the first instance it is easily possible to give four or five erythema doses in a few minutes, while with the higher filters and voltages, hours are required instead of minutes to exceed the proper limits of skin exposure. This, however, is true that with long skin distance and high filtration the high percentage depth dose which is possible under these conditions, may result in deeper sloughs. In any case it is evident that the possible skin dose is the limit to the exposure for a given area.

The determination of such dose becomes, therefore, a matter of primary importance before deep therapy can be properly administered as insufficient raying stimulates tumors instead of retarding their growth.

With heavy filters of any of the metals employed the methods previously used to determine dosage are extremely unreliable. The stimulation of the characteristic radiation of silver at about twenty-five K. V. renders photographic methods misleading. A similar error attends the use of pastilles containing barium and platinum, in addition to the fact that such pastilles are insensitive to short wave lengths.

Simple and accurate ionization chambers are not at present available. The use of types such as may be found in any physical laboratory implies the employment of electroscopes or highly sensitive galvanometers. In addition, their readings are by no means necessarily indicative of the biological dosage. With the advent of more powerful x-ray apparatus yielding voltages of two hundred thousand and over and a vastly larger output of x-rays through thick filters, the development of a convenient method of determining not only the skin dose, but also the amount reaching the tissues at a considerable depth, is imperative.

Unless the depth dose is known, it is perfectly possible by using four or five portals to administer sufficiently large amounts of x-ray so as to cause serious injury to internal organs or even to induce sloughing of the walls of the hollow viscera with fatal results. Fortunately, some types of cancer, though not all, are more susceptible to rays than normal tissues, a point about which develops all possibility of effective radiation treatment. But often the border line is a very narrow one; hence dosage must be accurate.

At present the only way for the x-ray therapist to estimate the proper dose is to determine the skin erythema with given sphere gap voltage, milliamperage, skin target distance and filtration. This is time consuming, and if the limit is accidentally exceeded annoying results may eventuate. After this, recourse must be had to tables of dosage

such as are published in current journals or in pamphlet form by Voltz and others. Measurement of the patient and estimation of the depth from the surface and thickness of the tumor give the other necessary data. The limits of error are evidently considerable and how much simpler the matter would be if a direct reading of all these factors could be obtained by an ionization chamber of such dimensions that it could, if necessary, be placed in contact with the tumor, if cervical, rectal, or prostatic, or under the patient if abdominal or thoracic, and direct readings in biological, not physical, units obtained.

With the scientific knowledge already available in this country such an apparatus could be designed and calibrated with a standard biological material and if a sufficient demand existed a number of firms in this country have the technical force available for their construction. I should like to see such an apparatus regarded as the essential part of the equipment of every one attempting deep therapy. Without such equipment comparable results are not obtainable and the successful therapy of those types of deep cancer amenable to x-ray delayed for another generation.

What are the scientific data necessary for the production of such a standard apparatus?

It has been often stated that the radiation effect on the cell is in direct proportion to the amount of energy absorbed by the cell. The amount of this energy for different wave lengths cannot as yet be accurately determined by physical means, but using an ionization chamber of aluminum, experiments conducted in the Crocker Laboratory have shown that equal ionization doses of unfiltered and of variously filtered rays do not have equivalent lethal effects on animal tumor cells. This has been confirmed by Kronig and Friedrich, who, however, demonstrated that

*Read at the annual meeting of the Radiological Society of North America, Chicago, Dec. 7, 1921.

with a chamber made wholly of horn and graphite, equivalent ionization doses had the same effect on tadpoles, on germinating seeds, the ovary and on the human skin, but they did not try animal tumors. It cannot as yet be considered absolutely settled that equal ionization doses are equally effective, no matter what the wave length of the x-ray. While it is probable that Kronig and Friedrich are correct, there are many who still believe otherwise.

Our nearest approximation to a biological standard now in use is the skin erythema dose. This, however, varies in individuals and over different portions of the body, as is well known, but as it furnishes the limit of all deep therapy it is still our only practical unit. Once obtained it is easily reproducible with the same x-ray apparatus under exactly the same conditions of working. It cannot, however, be necessarily transferred to any other make of apparatus, by any process of arithmetic. The yield of the tube depends upon many factors; the wave form which in turn depends upon the construction and adjustment of the rectifying switch, the transformer characteristics, and many other variables. Each machine must, therefore, be checked upon a human being, as has been said, which is time consuming, and if the limit is exceeded may produce permanent injury. If, however, some constant biological material was available, which required a given x-ray or radium dosage for its destruction, it would be easy to calibrate an x-ray machine or an ionization apparatus which would in turn give exact control over the workings of the machine.

Such a test object is available in one type of the transplantable tumors of animals. Those suitable for this purpose are transplantable in a high percentage in all breeds of white mice, and practically do not regress, except in rare instances. The animals are cheap and easily kept. They can be inoculated with the tumor and when this has reached a convenient size, it may be exposed to a dose some multiple of the assumed erythema. The strain upon which the largest number of observations have been made is Crocker Fund 180 and with it this factor is five. (1) After the exposure, the tumor is excised and bits are grafted on a series of animals. If the dose is correct no tumors will appear. If too low, some

will come up after a few weeks, or months, greatly slowed in their growth rate. Another tumor can again be exposed for a slightly longer time, and thus by a few trials the mouse tumor dose determined.

Such a test is more time consuming, however, than the determination of the erythema dose and obviously cannot be generally used. It would be far better if the x-ray apparatus could be biologically calibrated by the maker before it left the factory.

This lethal tumor dose has been determined on No. 180 for four successive years, using the same machine, which has not been altered in its adjustment, and checked with the same ionization chamber and has not varied. The deflections of the galvanometer have been within a couple of millimeters of the same point each time the machine has been run. It is made of aluminum after the design of Professor Wm. Duane. Recently a new set of machines of much higher power were installed under my supervision in another institution. Using the same voltage, distance and filters, and adjusting the current to give the same ionization deflection, the tumor was killed in the same time, as with the older apparatus, and the erythema dose on human skin was also found to be the same. With these factors available, the erythema dose for varying distances, voltages and filters was quickly obtained and in a few weeks the plant was treating effectively a large group of patients, with heavy dosage, yet without skin burns. For example—the lethal tumor dose at 166 K. V. 5 M. A. 40 cm. distance, 0.5 mm zinc and 1 mm. aluminum was found to be 180 minutes. The erythema was posted as a safe limit for the staff as not to exceed one-sixth of this, or thirty minutes to start with. Careful checks on patients have shown that under these conditions the true erythema is between thirty-five and forty minutes, depending upon the region treated.

The erythema dose which we use is a faint reddening produced on the skin of the chest or abdomen after seven to ten days, followed by slight desquamation and ultimate browning. It is apparently the same as that of Seitz and Wintz, but not more than half of that used by Warnekros, who defines an erythema dose as such an amount as will not cause irreparable damage to the skin. The Warnekros dose, of course, causes skin atrophy and telangiectasis and should not be used on exposed portions of the body, and is so near the limit of permanent damage that it cannot be repeated on a sensitive skin.

The mouse tumor dose, however, is a fixed quantity and not variable like

the erythema. It is determined by one fact only, the death of all the tumor cells. If any survive, a tumor will grow from the transplant.

Can the fact that a highly malignant mouse tumor requires five erythema doses to kill all the cells at one treatment, be used as a guide to the therapy of tumors in man? I believe that it can, and should. The resistance of this tumor is comparable to that of the more malignant types seen in man, such as the tumors of the intestinal tract, the squamous celled epitheliomata, but it is less than that of the melanomata and many of the bone and periosteal sarcomata in man, which often resist extraordinarily large doses. A slow growing fibrosarcoma of the white rat (Crocker Fund 37) for example, requires some eight erythema doses to kill it. Other animal tumors, however, may be killed with two or two and one-half doses, and correspond to the more susceptible growths seen in man.

It is very dangerous to assume that the proper carcinoma dose for human therapy is that which results in the destruction of a subcutaneous metastatic nodule from a carcinoma of the breast, as Kronig and Friedrich are careful to point out. They say that such disappearance may be only temporary after their "carcinoma dose" and recurrence take place later. This statement seems to have been overlooked by many writers who have assumed that the "carcinoma dose" necessarily means a curative dose. The conditions are entirely different from the primary tumor. The metastatic nodule, as shown by animal experiments, is certainly at least twice as susceptible and this susceptibility is probably due to the surroundings, imperfect vascularity, etc., of the embolic particle. When freshly deposited it will often disappear after the erythema dose, but if it does not every x-ray worker knows that at least a burning dose, say one and five-tenths skin erythema doses, is necessary, and when invasion of nearby bone or cartilage has taken place a still higher dose is necessary. Even a basal-cell carcinoma, the most benign type we know, is more difficult to handle after it invades bone or cartilage. It is often loosely assumed that the cells have become "immune"—an utterly illogical assumption.

The fact (1) that mouse tumors which have been exposed to nearly lethal doses in the animal's body, and then allowed to remain for ten days before inoculation, show a much lower percentage of takes than when they are immediately transplanted, has been cited as showing, but does not prove,

(1)—The details of these experiments have been published in the *Jour. A. M. A.*, 1920, LX. They have been repeated in Germany by Keysser and others, who are, apparently, unaware of our work. The lethal dose with radium for this tumor was also published in the *Annals of Surgery*, 1915.

(1)—Keysser, *Munch. Med. Woch.*, 1921, 68, p. 4.

that the tumor cells have been killed by any tissue, or immunity, reaction. It merely shows that when the transplantation is done immediately the cells are still in a healthy condition, and, therefore, the few which are going to survive are able to get started before the radiation changes begin, for it only takes about four days for a graft to organize its blood supply. If, on the other hand, the tumor is transplanted after eight or ten days, when the cells are all seriously injured by the development of the full x-ray or radium effect, the graft is in no condition to withstand the trauma and partial necrosis which such grafts always undergo when transplanted into a fresh soil before the capillary supply is organized.

Cancer cells do not become immune to repeated radiations, for if a mouse tumor is rayed with a sublethal dose and inoculated and again rayed and inoculated, and this process repeated a number of times, it still may be killed at the end of the series with exactly the same dose as at the beginning. The fact is rather that the cells of the resistant tumor are just the same as before, but that it is now impossible to attack the tumor through its blood vessels, which is all we do in many instances. The cells lie diffused through an avascular connective tissue, and while some may be killed, others remain to grow again at a much later period.

This is the condition so often noted when a tumor has previously been treated with radiation or caustics, a notoriously unfavorable condition. There is no evidence that the tumor cells have changed or become more resistant.

The carcinoma and sarcoma doses of Seitz and Wintz, or Kronig and Friedrich, are, therefore, not generally applicable to all tumors, only the lymphosarcomata, and the basal cell carcinomata are permanently curable with an approximate erythema dose, and even these tumors occasionally show full resistance. Many, though not all of the carcinomata of the cervix, however, seem to be much more susceptible to radiation than tumors of similar morphology in other parts of the body. While an occasional lymphosarcoma will be permanently cured, it is too often multiple and inaccessible to offer anything but an accidental cure. The skin and cervix tumors are at present the great field for radiation, though if easily operable, both should be removed, to be followed by prophylactic raying. How difficult judgment is in these matters, and how imperfect as yet our knowledge of biological dosage and preferable technique is illustrated in the somewhat active discussion now going on in Germany concerning the value of what has been generally assumed was one of the best established fields for the x-ray, that is, post-operative raying after carcinoma of the breast.

CONCLUSIONS

I. It is extremely difficult to properly calibrate an x-ray machine for deep therapy as the difference between a stimulating and inhibiting dose for tumor cells is not very great, while the difference between the dose necessary to inhibit or kill the cancer cells and that which may cause serious injury or

even death of the patient is also unfortunately very small.

II. Exact surface and depth dosage is, therefore, a necessary preliminary to deep therapy. This is rendered difficult at present by the lack of suitable instruments calibrated in biological dosage such as a standard skin erythema.

III. The best way to calibrate such an instrument when constructed is by the use of a mouse tumor of constant and tested biological qualities. Such a tumor is the Crocker Fund No. 180. In five years of study, it has shown no variation in its x-ray lethal dose and this tumor takes in practically one hundred per cent, grows rapidly and regresses in only a fraction of a per cent in mice of any available market stock.

IV. The lethal dose for this tumor for x-ray of any voltage and any filtration is approximately six erythema doses as measured by a faint redness after ten days on the most sensitive skin areas. About five doses for heavily pigmented skin of the back and about two and one-half to three severe erythemas of the Warnekros standard.

V. In comparison to human tumors, it shows about the same resistance to x-ray as the highly malignant neoplasms of the intestinal tract which as yet evade successful radiotherapy.

VI. The lethal dose for radium for this tumor being also known, it furnishes the means for a biological comparison between the action of x-ray and radium and permits the estimation of equivalent dosage.



The Possibilities of Pneumoperitoneum in Gastro-Intestinal Diagnosis

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MUCH has been written on the subject of pneumoperitoneum as an aid to x-ray diagnosis of intra-abdominal lesions, but very little mention has been made of its application to examination of the gastro-intestinal tract. The use of opaque salts for examination of the stomach and intestines has practically established itself as the most efficient single method of gastro-intestinal diagnosis. There is absolutely no question of the efficaciousness of the present method of gastro-intestinal diagnosis, and any method which would supplant it must needs be very efficient indeed. The problem which does present itself, however, is to detect the weak places in the present method of examination and determine whether pneumoperitoneum will be of aid under these circumstances.

With the barium meal the portions of the stomach most accessible to examination are the greater and lesser curvatures, and the pyloric region. It utilizes a medium of increased density, while in pneumoperitoneum a medium of decreased density is employed; namely, gas. This is supplied by administration of Sedlitz powder. With a barium meal, the ordinary postero-anterior view shows very clearly, silhouetted against the softer structures, the presence of irregularities, filling defects, niches and incisurae. The examination is practically limited, however, to this single viewpoint. Fortunately, by far the greatest majority of pathological lesions of the stomach are confined to these parts and consequently the single viewpoint suffices in the majority of cases.

There are, however, a certain percentage of cases in which lesions are present in the anterior or posterior wall of the stomach. At times even the most intensive barium examination fails to detect the pathology. I recall very distinctly the case of a man with metastatic nodules in the liver, which had been definitely demonstrated with pneumoperitoneum, but because of practically no gastric symptoms or pathological findings in the stomach we entertained the diagnosis of primary carcinoma of the liver. There was no disturbance in gastric mobility, motility or peristalsis; no filling defect could be detected even by diligent search, and

numerous plates showed no evidence of involvement—yet, at autopsy, a carcinoma about three inches in diameter was found in the pars media on the anterior wall of the stomach. It is in

In the examination of the stomach by the aid of pneumoperitoneum it is well to start with a perfectly empty stomach; if there is any retention it is even advisable to wash the stomach out



Figure I.—In the postero-anterior view the stomach is much the same as with a barium meal examination, but not nearly so distinct.

the examination of the anterior and posterior wall of the stomach that this method is most efficient, and I am quite confident that in this case it could have been easily detected had the examination of the stomach been made while the patient was undergoing pneumoperitoneum examination.

thoroughly previous to examination. The abdomen is cleansed, painted with iodine, and pneumoperitoneum is produced by inserting a lumbar puncture needle into the left lower quadrant. The apparatus which we use is very simple, consisting of a lumbar puncture needle connected to the pump of a Potain as-

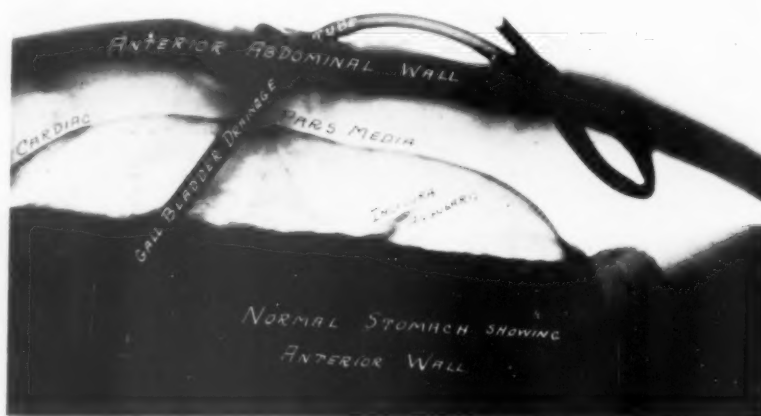


Figure II.—Anterior wall of stomach, descending portion, seen in the dorsal position. Note incisura angularis.

*Read at mid-year meeting of the Radiological Society of North America, Boston, June 3 and 4, 1921.

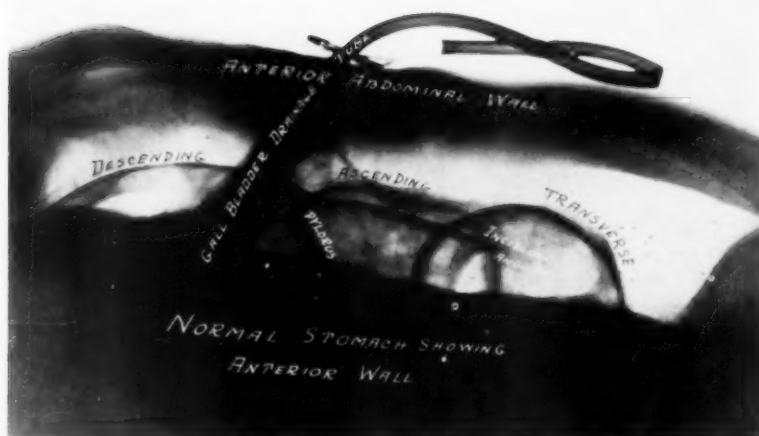


Figure III.—On rolling the patient slightly to the left the transverse and part of the ascending portion of the stomach come into view.

pirator by suitable tubing and connectors, with a Murphy drip interposed (vent hole plugged) to prevent introduction of foreign material from the pump. We make no attempt to sterilize or filter the air and deflation at the end of examination should be practiced routinely.

The patient being properly inflated, the examination of the stomach itself is then undertaken. To render the stomach wall visible the stomach itself must be inflated, and this accomplished by administering the two powders of a Sedlitz powder in separate solutions. If the patient's stomach is washed out on account of a residue prior to examination there would seem to be no objection to inflating through the tube.

The patient is examined before a vertical fluoroscope while lying on his back. The anterior stomach wall will be seen bulging forward and peristaltic waves can be very clearly seen originating in the cardiac end of the stomach and passing toward the pylorus. Rolling the patient slightly to the left, the pyloric ring and first portion of the duodenum can often be seen. On examining the patient with the horizontal fluoroscope, the gas filled stomach casts a shadow very much the same as the postero-anterior view of the stomach with barium meal examination. The image, in this position, is not so clearly visualized, however, and the same detail and outline of a barium meal shadow is not always attained. Using a barium meal in conjunction with pneumoperitoneum does not seem to be of great advantage.

Tumors of the posterior wall of the stomach, the other type of lesion in which this method would seem to be of advantage, are best demonstrated by

placing the patient in the retroperitoneal position. This consists in placing the patient in the prone position, supported by two blocks, one beneath the chest, the other under the thighs. This takes all pressure off of the abdomen and allows the abdominal wall to sag forward. The intestines and all organs with mesenteric attachment fall freely forward and render the retroperitoneal structures visible. A prevertebral clear space is produced which when unobstructed by very great enlargement or extensive adhesions of the liver gives a clear impression of the posterior wall of the stomach. In this position, even more than in the position for observations of the anterior wall, close study is necessary for proper orientation. The vertical portion of the stomach can be seen extending somewhat obliquely downward, while the transverse portion

bulges backward into the prevertebral space. It is likewise quite possible that this position will render the second and third portions of the duodenum directly visible, and diverticula of this region should be easily localized. Tumors of the head of the pancreas can be shown in their relation to the duodenum, but probably not more accurately than by ordinary methods.

Adhesions of the small intestines to the surrounding organs and to the abdominal wall constitute the most important lesions of the small intestine which can be demonstrated. This is by far the best method for showing post-operative adhesions to old abdominal scars, and even very extensive adhesions associated with tuberculous peritonitis can be shown. Where intestinal obstruction is present, as a result of old adhesions, this method will probably not serve to localize the site of obstruction any more accurately than the ordinary methods. When inflammatory lesions are present as a result of subacute peritonitis the condition can be readily recognized, since the intestines, instead of being easily displaced with changes in posture, are fixed in position. We have had several such cases and have no reason to believe that induction of pneumoperitoneum under these circumstances has any deleterious effect.

The contents of hernias, especially ventral hernias of the anterior abdominal wall, can usually be established without difficulty, pneumoperitoneum disclosing either the gas filled hollow viscus, or the dense omental tissue. When the operative findings are not known and there is a suspicion of malignancy of a stomach involved in a post-operative scar or hernia, this method gives excellent information, not only as to the possibility of malignant



Figure IV.—On rolling the patient still farther on the side, the pyloric portion and pyloric ring became visible. Note the adhesions of the pyloric portion of the stomach to the gallbladder fistula.

involvement, but also as to the portion of the stomach involved in the hernia or adherent to the scar.

In examination of the large bowel it is extremely necessary to acquaint oneself with the appearance of the normal before undertaking any inferences of pathology. When the patient is placed upon the left side, in the lateral position, the ascending colon sags freely to the midline in almost its entire extent with the exception of the caecum. It is well known that there is wide variability of motion at the caecum in different individuals, so that the extent of normal mobility can be determined only after many examinations. This method will, however, give information as to the extent of passive mobility of the caecum, and where a subacute appendiceal mass is present will show clearly its extent and limitations. Where there are no pathological adhesions, very little discomfort is experienced by the patient in the displacement of the intra-abdominal organs due to change in position; where, however, pathological adhesions are present, whether in the appendiceal region or in the region of the liver, any change in position which tends to put them on a stretch, will cause very distinct pain. This point will aid more than any other in distinguishing true pericoecal adhesions from normal attachments of the caecum. The hepatic flexure rarely shows attachment to the liver, but the splenic flexure almost always has an attachment to the lateral abdominal wall and spleen which holds it more or less firmly in

place. When this structure, attached to the spleen and trailing down into the pelvis, was first encountered we were at a loss to explain its identity, but a barium injection soon revealed the nature of the structure. For the detection of carcinoma of the large bowel this method cannot be substituted for the barium enema, but in determining the extent of infiltration of such a carcinoma the method is of the greatest advantage. In a carcinoma of the descending colon the process was shown infiltrating the lateral abdominal wall and extending into the retroperitoneal tissues, involving the kidney above and extending well into the pelvis below.

It will be seen from this brief resume

that pneumoperitoneum examination of the gastro-intestinal tract, at least at the present state of development of technique, cannot be used as a substitute for barium meal examination; that it is especially applicable to certain lesions of the stomach most difficult to detect by barium meal examination, notably lesions of the anterior and posterior stomach wall; that it is practically the best method of examination to determine the contents of hernial sacs and adhesions of the intestines and stomach to each other and the abdominal wall, either post-operative or otherwise; that with a somewhat wider experience it may prove of great advantage in subacute or chronic appendicitis; that while it is not the best method of demonstrating carcinoma of the large bowel it is of great advantage in determining the extent of infiltration and the organs involved.

Aside from the very obvious advantages in the instances mentioned above, I feel that there are possibilities in the direct visualization of the pyloric ring and duodenum, which can be worked out by more painstaking technique and closer study, that may make the method of particular advantage in this location. In any event, the method demands more extensive consideration from those who wish to avail themselves of all aids in diagnosis and who wish to give the patient the benefit of all helpful methods at their command.

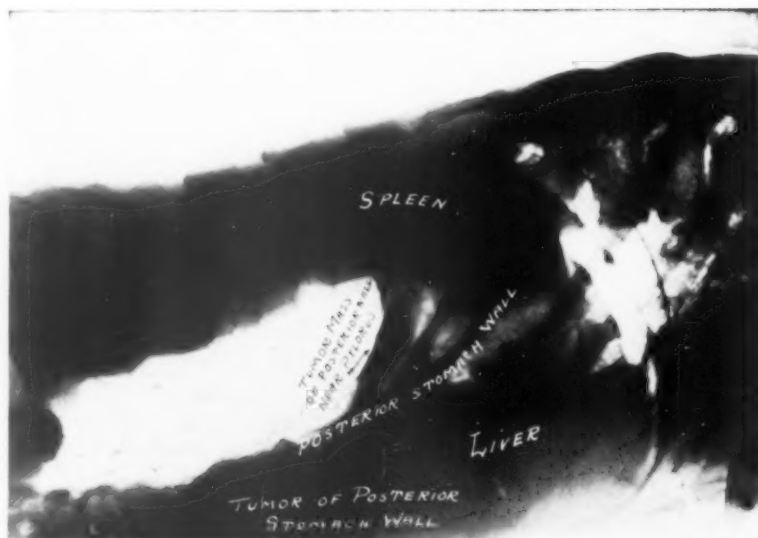


Figure V.—Tumor of the posterior wall of the stomach in the pyloric region which could not be demonstrated by barium meal examination. Note the posterior stomach wall in the descending, transverse and ascending portion of the stomach.

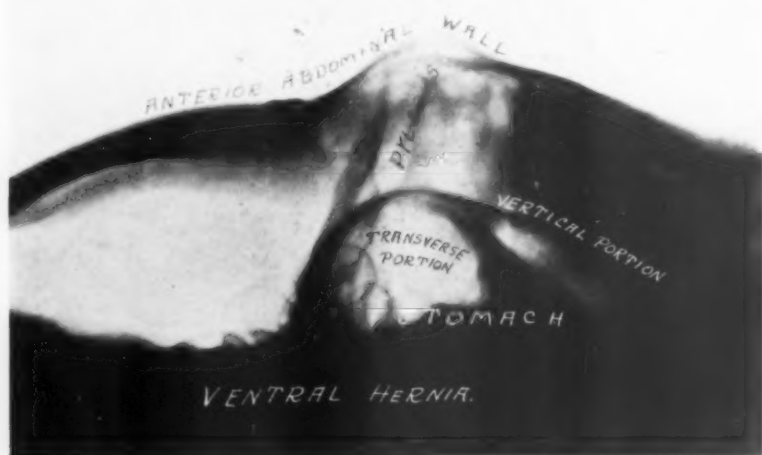


Figure VI.—Pyloric portion of stomach involved in a ventral hernia. Note the appearance of the transverse and descending portions of the stomach.



Figure VII.—Massive adhesions of the intestines in an inflammatory mass surrounding a ruptured gallbladder. Note the intestines do not fall away as they should normally, but are firmly fixed in place.



Figure IX.—Normal attachment of the cecum in the left lateral position.

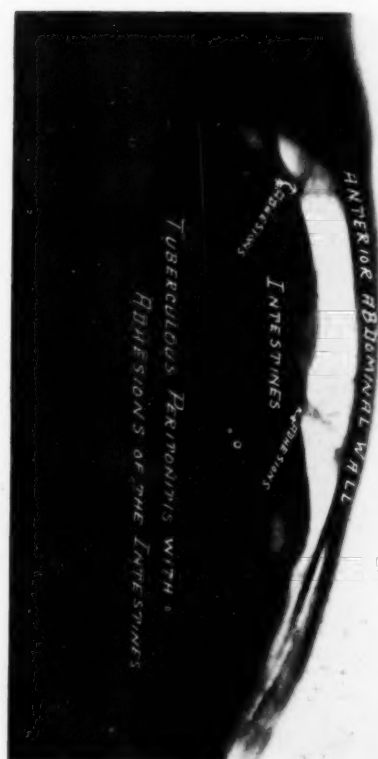


Figure VIII.—Tuberculous peritonitis, showing adhesions of intestines to each other and to the abdominal wall.



Figure X.—Normal attachment of the large bowel. The colon is attached at the splenic flexure to the spleen and lateral wall; there is occasionally a similar attachment at the hepatic flexure to the liver; this is the exception rather than the rule, however.



Figure XI.—Carcinoma of the descending colon, infiltrating the lateral wall involving the retroperitoneal tissues.

X-Ray Studies of Mediastinal Shadows with Special Reference to Dermoid Cyst

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OF the many conditions found roentgenologically in the mediastinum, neoplasm, either primary or metastatic, is not frequent. Aneurysm of the arch of the aorta is quite common and may be mistaken for a neoplasm. Other shadows may be due to Hodgkin's disease, enlarged thymus, substernal thyroid, abscesses, echinococcus cyst and dermoid cyst. Fibromata, chondromata and lipomata (benign neoplasms) have rarely been found, and although they may occur, they have not been demonstrated roentgenologically so far as I am aware.

Of the malignant neoplasms, sarcoma is more common than carcinoma. Sarcoma is usually primary in the form of lymphosarcoma. Lymphosarcoma, however may be secondary. Sarcomatous shadows vary in size and contour and those due to metastases often appear rounded and circumscribed. These may be small or very large, and usually multiple. Lymphosarcoma usually manifests itself as a large single shadow and may occupy the greater part of the chest. Metastasis frequently follows malignant sarcoma of bone and may also follow sarcoma of the tonsils, cervical lymph nodes, the breast, or other regions of the body.

Primary carcinoma of the mediastinum arises from the mucous membrane of either the esophagus or trachea and rarely from the remains of the thymus

gland. It may occupy either the right or left side of the mediastinum or may occupy both sides.

It is not, as a rule, confined to the mediastinum alone and not infrequently involves the lung and pleura as well. Carcinoma of the breast not infrequently metastasizes to the mediastinum although metastases may also be due to carcinoma elsewhere in the body. It is difficult to absolutely differentiate roentgenologically between primary and metastatic carcinoma; however, the clinical history may help to decide. The shadows in primary carcinoma are usually irregular in outline and often invade the lung and pleura. Shadows due to metastatic carcinoma are usually more regular in outline and are apt to be limited more to the region of the mediastinum, although invasion of the lungs is not infrequent. In neither the primary nor the metastatic carcinoma have we seen calcified shadows.

Aneurysm of the arch of the aorta may be mistaken for neoplasm. It may be differentiated from neoplasm more quickly and probably better by the roentgenoscope than by any other method, through observation of the expansile pulsation. One must be careful, however, and not mistake a normal pulsation, transmitted to an adjacent neoplasm, for an aneurysm. Roentgenographically the periphery of an aneurysm has a somewhat wavy appearance, as its borders are not sharply defined, due to pulsation. In neoplasm simulating aneurysm the periphery is usually well defined.

Hodgkin's disease, roentgenologically, resembles somewhat lymphosarcoma; indeed, the mediastinal shadows of these two diseases cannot be absolutely differentiated. In the former the shadows probably are not as large as in the latter. Hodgkin's disease as a rule makes its first appearance in the neck and later involves other regions. The mediastinal involvement is usually a later manifestation of this disease.

Enlarged thymus is occasionally manifested by a shadow occupying the anterior mediastinum. A history of difficult breathing, substernal dullness with pressure symptoms, especially in infants or young children, should arouse suspicion of enlarged thymus.

Abscess in the region of the mediastinum not infrequently is due to an extension of an inflammatory process from the lung and pleura. It may also follow infectious processes of the ribs, sternum or cellular tissue of the neck. Occasionally an amebic abscess involving the lung extends to the mediastinum. Roentgenologically a mediastinal abscess usually has a sharply defined border. It may be fairly large. No pulsation is visible roentgenologically. The shadows are not quite as dense as those due to neoplasm.

Echinococcus cyst, which is very rare, occasionally involves the mediastinum. Its common site is the right side in the region of the base. It may be attached to the diaphragm and not in-



Figure I.—Large tumor shadow occupying the right and left mediastinum and half of right and left upper lobes, due to metastatic lymphosarcoma. Patient had lymphosarcoma of the tonsil five months previous which was operated and removed.



Figure II.—Marked infiltration of both apices and upper lobes, in all probability metastatic lymphosarcoma. The infiltration appears well organized and regular. Patient has lymphosarcoma arising from the wall of the pharynx.

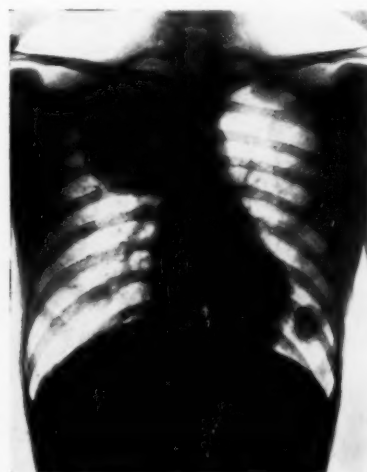


Figure III.—Large rounded circumscribed tumor shadow occupying right apex and upper lobe. There are also smaller rounded circumscribed shadows in the right and left lower lobes. Patient had amputation of the femur three years previous for periosteal sarcoma. The circumscribed rounded tumor shadows are quite characteristic of metastatic sarcoma.

*Read at mid-year meeting of the Radiological Society of North America, Boston, June 3 and 4, 1921.

frequently is an extension upward from the liver.

Dermoid cysts arise in the mediastinum and vary in size from that of a walnut to that of a child's head. The small tumors remain in the mediastinum while the large ones may extend outward into the pleural cavity. A few have been described occupying the right base. In shape they are usually spherical, but may be flattened when in contact with the diaphragm. The cyst wall may be very thin or quite thick, and is invariably adherent to surrounding structures, most commonly to the pleura. Partial calcification of the cyst wall has occurred in a number of cases. Cholesterol crystals are a common finding, and in the majority of cases the cyst same time she noticed a slight bulging over this area. Since that time the right

chest has bulged and tumor has grown to the size of a peach. Pain has disappeared entirely. No other symptoms noticed except a lump. About a week ago patient developed a cough with coryza and general malaise. This has grown worse in the last few days. Dr. Bloodgood has had patient under observation for the past two weeks. He referred her to Dr. Kelly for radium treatment and patient has received seven treatments. Mother thinks the tumor has grown smaller and softer since treatments. also contains hair, epidermis, cartilage, bone, teeth, etc.

Heuer of Johns Hopkins, who reviewed the literature of dermoid cyst of the mediastinum, stated that Roger Morris collected a series of fifty-seven cases in 1905; Dangschat collected a series of forty-four cases in 1903; and Pohl collected a series of fifty-two cases in 1914. Very recently Hertzler reported a case of dermoid cyst of the mediastinum in his Clinical Surgery.

Our case is one of a white female, age 14 years. Admitted to Saint Agnes' Hospital December 12, 1920.

Family History—Unimportant. Parents living and well. Uncle on father's side died of cancer, otherwise negative.

Past History—Had measles, whooping cough and scarlet fever. Subject to frequent colds. Tonsilitis several times. Otherwise negative.

Present Illness—About four weeks ago, without any history of trauma, patient noticed a dull aching pain at upper end of sternum. At about the

Physical Examination—Patient is a well nourished child of about fourteen years, complaining of a slight cough. Perfectly oriented in all spheres. No dyspnea, edema, jaundice. Skin is darkly pigmented, otherwise clear. Veins of left side of face and neck most prominent. The head is negative. The mouth and naso-pharynx are negative excepting that the tonsils are greatly enlarged and almost meet.

Thorax—Asymmetrical, the right chest apparently bulging slightly. In midline is seen a semispherical tumor about the size of a peach at the upper end of the sternum. This is soft and attached to the bone with a definite edge. The heart sounds are normal. On percussion there is a flatness from about the third rib on the right side out almost to axillary line. This cannot be separated from the liver dullness. Percussion on the left is normal except that the retromanubrial dullness is greatly increased. Many mucous rales can be heard at the right apex and hilum, and at times a definite friction fremitus is heard to the right of the upper portion of the sternum.

Abdomen—Liver two fingers below costal margin, otherwise negative.

Extremities—Negative.

Blood—3,660,000 red blood corpuscles, 6,600 white blood corpuscles, hemoglobin, 68 per cent.

Urine—Negative except for a slight trace of albumin.

Roentgenoscopically there is a large rounded tumor shadow occupying the greater part of the lower two thirds of the right side of the chest. On deep inspiration this shadow moves freely and reveals lung structure posteriorly and below. The liver shadow appears somewhat depressed. It apparently is slightly attached to the diaphragm near the median line. No pulsation can be seen in this region. The upper right lobe and apex appear clear. The left lung is clear. The heart shadow is



Figure IV.—Metastatic sarcoma of mediastinum and lungs twenty months after operation for sarcoma of the breast. The shadows are well defined spherical and dense, quite characteristic of metastatic sarcoma.

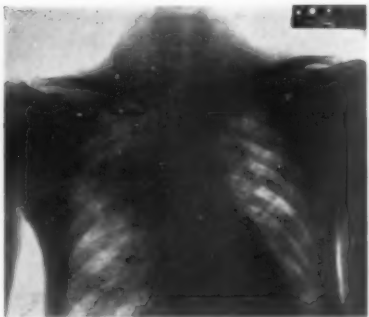


Figure V.—Primary carcinoma of the lung. The infiltration involves the right hilum and upper lobe.



Figure VI.—Metastatic carcinoma right mediastinum and lung eighteen months after operation for breast carcinoma.



Figure VII.—Extensive infiltration of both lungs due to metastatic carcinoma. Patient has carcinoma of the sigmoid and rectum.



Figure VIII.—Dense fibrous infiltration of right apex and upper lobe extending downward toward the hilum. Infiltration simulates neoplasm, but is in all probability healed fibrous tuberculosis. Patient gives a definite history of tuberculosis.

displaced well to the left, probably the result of pressure by this tumor. The heart appears slightly enlarged. There is marked gradual curving of the dorsal spine backward. Stereoscopic roentgenograms and later roentgenograms of the chest confirm the above findings.

Impression—From the history and the above findings this tumor shadow is probably due to a large dermoid cyst. However, an echinococcus cyst is to be considered.

Operation—December 23, 1920, by Dr. Bloodgood. His notes of the operative findings are as follows: Novocaine. Incision made over swelling over sternum. This proved to be a cavity filled with thick yellow pus and granular debris, but on opening, adhesions of this cavity to chest could not be found. Incision then made below breast, nipple line, and rib removed. We then encountered, after dividing parietal pleura, a cyst. On opening it was found to be four mm. thick and to contain same material as cavity over the sternum, also hair. This made the diagnosis a dermoid cyst. Cover slips from piece showed no bacteria, no leukocytes.

Frozen section (of wall) showed fibrous tissue, no evidence of tuberculosis. Epithelial lining not seen.

The cyst rested upon the diaphragm below, to which it was slightly adherent, but from which it could be easily separated. To the outer side and above was the lung, with very few adhesions. This portion of the cyst could be separated, but the larger portion under the mediastinum could not be separated from the pericardium and further attempt at enucleation produced falling of blood pressure and rapid pulse. When this manipulation ceased, blood pressure rose and pulse improved. A

Brewer tube was sutured into the cyst and three pieces of long gauze, wet in salt, were packed in between the cyst and surrounding tissue.

Post Operative Course—Immediate rate of respiration. Patient had very acute thirst and drank about two or more liters of water each twenty-four ly after operation there was increased hours. The urine output ranged from three hundred to six hundred cc. in twenty-four hours. Before operation the urine was negative for casts with only a slight trace of albumin. It now showed plus one albumin and many casts. The temperature ranged between one hundred and three and one hundred and four.

For three days after the operation the pulse ranged between one hundred and forty and one hundred and sixty. The respiration averaged about fifty. There was rather free drainage around the tube. The amount of drainage through the tube was considerably less, being about two hundred cc. a day.



Figure X.—Large mediastinal tumor occupying greater part of right side of chest. Stereoscopically the tumor appeared more or less rounded in contour. Found five years after empyema. Exact nature of tumor not determined.



Figure IX.—Large fusiform aneurysm. Marked expansile pulsation noted roentgenoscopically.

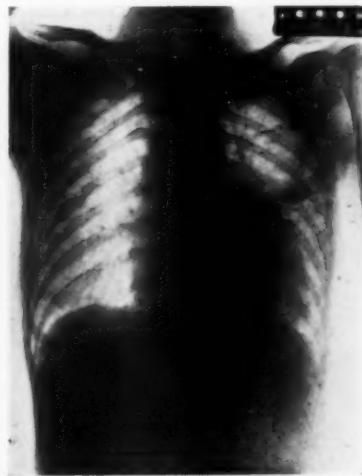


Figure XI.—Localized and well defined shadow in the region of the left hilum, mediastinum and part of the lower lobe, following pneumonia. In all probability walled off abscess.

Examination of lungs showed pneumonia of right lung.

The night of the second day after operation, because of the decreased output of urine, patient was given magnesium sulphate and the bowels moved seven times during the night. The next morning the patient appeared very much better. The respiration had decreased to forty, and the pulse to one hundred and forty and the temperature to one hundred and three. The pneumonia of the right lobe seemed to be clearing up. There was very little cyanosis. During the afternoon patient's pulse, respiration and temperature rose suddenly, the respirations reaching sixty and the pulse one hundred and eighty and very weak. The patient became very cyanotic and died in about an hour after the sudden change was noticed.

Necropsy by Dr. W. C. Caldwell—His notes are as follows: The Brewer tube and the drains were removed. On introducing the hand into the cavity through the incision, it was found that the large cyst had occupied practically the entire space of the right lung, the right lung being pushed up into a small space in the region of the clavicle and apex. The cyst extended from the mediastinum to the liver, to the chest wall, and almost to the clavicle. There was a definite pneumothorax as the cyst had decreased somewhat in size, since drainage. On attempting to detach the cyst, it was found to be very adherent above, in the region of the clavicle, but particularly in the mediastinum, where it was so firmly attached that one was unable to separate it with the gloved hand. On opening the cyst it was found to contain a tumor mass about the size of an orange attached at the upper portion of the cyst. This tumor mass was removed. It was impossible to remove the cyst wall intact,



Figure XII.—Three weeks later, spontaneous rupture into bronchus with disappearance of shadow.

but a portion of the cyst wall was removed for examination. Examination of the small compressed lung showed what was apparently red hepatization. A block of this was removed for examination. There was now a cavity in the position formerly occupied by the right lung as large as a child's head.

Gross Pathology—The tumor mass which was irregular in outline, was soft and spongy in consistency, had a pinkish white appearance and looked very much like skin. It was covered with short fine hair. On section, the skin surface had a thin layer of connective tissue beneath, very similar to normal skin. Deeper down there was considerable fat and a connective tissue stroma. Piece of the cyst wall showed a very dense hard fibrous tissue almost like cartilage. Piece of lung showed consolidation.

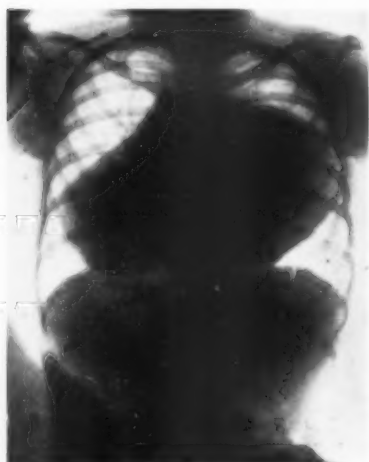


Figure XIII.—Dermoid cyst occupying greater part of the right side of the chest. This tumor is somewhat spherical and there is no expansile pulsation roentgenoscopically. The possibility of echinococcus cyst was considered because of its site. Cyst markedly adherent to the mediastinum and sternum so that it could not be completely removed.



Figure XIV.—Gross specimen of dermoid cyst, showing its skin-like covering and numerous hairs.

Microscopic Study—Section of the cyst wall was very similar to that described immediately after the operation. It was composed of very dense fibrous tissue and there was no evidence of an epithelial lining. No hair follicles, no sebaceous glands, no sweat glands.

Section of the tumor showed an epithelial covering very much like skin. There were hair follicles, sebaceous glands, and sweat glands. Beneath the epithelium there was subcutaneous connective tissue and fat.

Section of the lung showed a chronic fibrosis with later chronic inflammatory tissue and fresh pneumonia in the stage of red hepatization.



Figure XV.—Section through cyst.

From gross and microscopic findings it seems that the dermoid tumor with a pus material was inclosed in a fine fibrous cyst which probably represents a reaction of the body in walling off the original dermoid tumor.

Final Diagnosis—Huge dermoid cyst of right lung, firmly attached to the mediastinum.

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DISCUSSION

DR. J. C. BLOODGOOD, *Baltimore*:

I do not know what I can add in the discussion, but all of us must realize that due to the x-ray we have revealed the fact that the mediastinum is much more commonly involved than we have ever thought, even in primary lesions and in secondary lesions.

One of the most interesting observations I can speak of, which has not been mentioned, is the therapeutic dose of radium. If you have a mediastinal shadow, irrespective of the history, give intense radiation and there will be, in the great majority of cases, a reduction in the shadow. That means sarcoma. I have never seen after radiation a mediastinal tumor that I felt was carci-

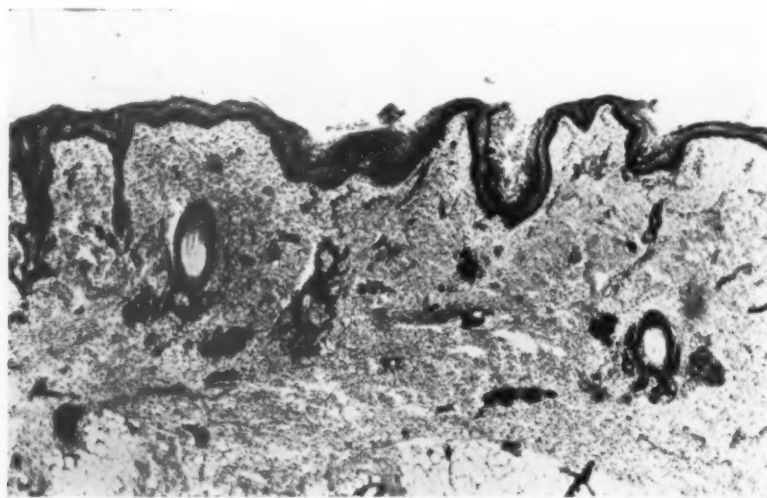


Figure XVI.—Photomicrograph of section of tumor reveals a definite layer of skin with hair follicles, sebaceous glands and sweat glands. Beneath the epithelium there is subcutaneous connective tissue and fat.

noma primary or secondary which showed any change whatever. In the little girl reported by Dr. Kahn, in which the huge size of the mediastinal tumor suggested a dermoid cyst there was no improvement whatever after radium. I felt it was unquestionably a carcinoma.

I do not for a moment feel that any of the sarcomata have been permanently cured by radium, but in all those we have been able to follow the sarcoma has grown very much smaller under radium. Of course, we can check a great number. There are primary tonsils and we take out the tonsils, or there are primary glands and we take out the glands and they show sarcoma cells. X-ray of the mediastinum is becoming a very important part of complete diagnosis. Unfortunately, we have not many autopsies.

The thing I am most interested in just now is the relation of mediastinal involvement in cancer of the breast. In the first place, here is a woman who has been operated on for cancer of the breast. She has some shortness of breath, some rheumatic pains, most of these patients are at the age where shortness of breath comes on irrespective of any malignant disease. Can you differentiate the shadows of cancer or malignant disease from some of the shadows we see in routine examination? If you take x-rays routinely of all your patients, you will see mediastinal shadows that are very difficult to differentiate. The reason I am calling attention to this point is that there seems to be a good many cases reported of mediastinal metastases after cancer of the breast. I think Dr. Kahn will agree

with me that of all cases of carcinoma of the breast in which the mediastinal shadow is of sufficient size to justify diagnosis, we have seen no improvement in the shadow nor are any of the cases permanently cured. I think perhaps some of the improvements are due to incorrect diagnosis of the mediastinal shadow. I think there is a great opportunity for all of us to attempt to keep most accurate records, especially of shadows in the mediastinum, so that when a patient with cancer of the breast comes up for routine examination with a shadow in the mediastinum we can watch that shadow. I do not know how many of you make the diagnosis of mediastinitis, but I would like to offer a prize to any one who has proved the diagnosis at autopsy.

Of course, with this little girl it was a great disappointment to fail to cure a perfectly benign tumor. Looking back, I think one mistake we made was to operate too quickly after radiation. This child had had intense radiation and then returned. The x-ray shadow was negative and we gave a second radiation. I feel now from my experience that that second radiation was unnecessary and that if radium was going to help that child it would have shown in two or three weeks. The failure to get a reduction in the shadow showed we were not dealing with a lesion that was amenable to radium. Some of my colleagues tell me that operation should not be performed too quickly after radiation. The radiation seems to lower the vitality of the tissues. One doctor tells me of a hysterectomy performed a week after radiation and the patient died of a streptococcal infection.

This little girl was operated shortly after radiation. Remember, this child had had no pressure symptoms and she had no trouble until the swelling appeared over the sternum. When I saw the shadow in the mediastinum and the swelling over the sternum, the probable diagnosis to me was tuberculosis. When I opened the swelling it looked like tuberculosis. I think that was a mistake. The question is, was it a mistake in operating and trying to remove that tumor. Some of you have not my record of thirty years of surgery. I have looked it over. I have had a very large experience in draining large cysts in the abdomen, especially pancreatic cysts. Whatever the technique, there is danger of secondary infection. All of those cases are infected, some of them die. I feel that when I decided to operate on this girl drainage was contra-indicated. I think Dr. Stewart showed that the drainage mortality was high. We did the operation under novocaine and the child was in good condition. We resected the rib and then with one hand we separated the cyst from the diaphragm and with the other hand we separated the cyst from the lung and it looked to me as though we would be successful. The mistake made was opening it. I should not have opened it. I thought by opening it I could reduce its size. Having opened it, I had to drain afterwards. I should have attempted to remove it without opening it. Having decided not to remove it, I should have left it alone and closed the chest wall. I think the child would be living today if I had not opened it. It was the opening and draining of the cyst that caused her death.



The Roentgen Ray in Uterine Fibroids,--Practical Deductions from One Hundred Consecutive Cases

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Chicago, Illinois

BEFORE entering into a discussion of my subject I want to summarize, briefly, the tissue changes induced by the roentgen ray, one of my objects to emphasize the similarity between the artificial x-ray menopause and the normal menopause.

First: X-ray produces an edema of the endothelial lining of the capillaries, which causes an endarteritis obliterans with a resulting anemia of the tumor⁽¹⁾ and to a limited degree the genitalia.

Second: X-ray inhibits ovarian stimulation. It affects first the ripe and ripening graafian follicles, then the primordial follicles, and last, the interstitial tissue. The effect of x-ray on menstruation depends upon the number of follicles that are destroyed. Amenorrhoea will persist if all of them are destroyed, but if only the ripe and ripening follicles are influenced menstruation will be resumed when the primordial follicles develop.⁽²⁾

Third: The tumor cells, and especially the nuclei, may at first show hypertrophy. The chromatin coagulates, is diffused, and may be displaced into the protoplasm. Later vacuoles occur and the nuclei are obliterated. Finally, nothing is left of the cells but detritus, which is carried away by the leukocytes. Young connective tissue gradually takes its place.⁽³⁾ The uterus atrophies.

The internal secretions are not interfered with at all, or at least not until later. This belief is upheld by several recognized authorities.⁽⁴⁾ Doctors Eden and Provis observe that there is no corpulence nor psychologic change.⁽⁵⁾ In the cases under consideration the absence of obesity and the minimized disturbances of the menopause lead me to emphasize this opinion. The interstitial tissue of the ovary (an important source of ovarian endocrines) is the last to be influenced and probably escapes with full functioning powers.

You will agree that x-ray produces in the uterus, ovaries and blood vessels a striking picture of conditions prevailing at the normal menopause.

If to make amazingly good records had been my only object, some of my cases would not have been undertaken. It is my conviction that the woman who is not a good surgical risk, or the

woman who must attend constantly to the affairs of her business or home, or the woman who is averse to surgical interference and who understandingly accepts our best efforts, without question or complaint, should be given her choice of procedure if her case, under x-ray promises a relief to symptoms and end result of good health.

If one would attain the greatest success, he must become expert in diagnosis; he must have made careful records from an intimate knowledge of the progress of each case; he must have a sufficient number of cases from which to draw conclusions and to develop prognostic accuracy. If these are constant factors, I concur with Doctors Eden and Provis, who conclude their report of seventy-six cases by saying that the risks of failures with roentgen ray treatment, in suitably selected cases, are so small as to be negligible.⁽⁵⁾

The size of the tumors included in this series varies from the smallest admitting of diagnosis to one the size of a full term pregnancy. We should not permit size of tumor to occupy too important a place in estimating prognosis. The intramural hemorrhagic myoma that grows below the umbilicus in a patient forty years of age or more yields almost one hundred per cent in good results. One tumor included in this series, which came an inch above the umbilicus, is now after three years entirely gone. Large tumors conforming to the favorable type should not be refused. But the large or small indurated fibrous tumor that is non-vascular, that gives no history of hemorrhage, recedes slowly, and the less satisfactory results or failures usually come from this type. The majority of these cases, however, after thorough raving and the lapse of several months, yield excellent results in health and comfort.

It is generally agreed that the most favorable age is forty years or more. The average age of the hundred under discussion is forty-five years, the youngest being thirty. I cannot see that my thirteen cases, less than forty, have experienced unusual difficulties due to the menopause. I have come to believe that the menopause induced at thirty-five or even younger, if plenty of time is given to the process, is not a fearful event. A longer interval between series and a reduction of the total dose is the better practice. I must admit, however, that the cases under forty years

of age have presented unusual difficulties in obtaining results, being more atypical.

It has long been considered a final edict that only uncomplicated fibroids should receive roentgen or radium treatment. After observations extending over five years we are convinced that certain associated pathology is not a contra-indication to the roentgen ray, but rather an argument for it.

In many of my cases there have been erosions of the cervix uteri, some of them deep and threatening. In these cases we are careful to direct the ray into the cervix. Repeatedly we have seen prompt healing. Degeneration of the cervical glands is treated in the same manner. The glandular structure is reduced, the muco-purulent contents evacuated and the entire cervix takes on a normal appearance. In every one of our cases the condition of the cervix is estimated and it is included in the path of the ray, if indicated.

Follicular cysts of the ovaries—those disturbances that furnish inadequate excuse for radical surgery—have been much improved by x-ray, but while we have never seen them aggravated and we confidently expect them to repair, no definite prognostication is made. The simple follicular cyst should not be confounded with any other kind of ovarian tumor, which is immediately surgical. Sometimes it is difficult to differentiate between a fibroid and a large ovarian tumor that occupies the median position, but if we remember that x-ray reduces the typical fibroid and never reduces the large ovarian tumor we will not consume much time in arriving at the right conclusion.

Hemorrhage has been controlled in ninety-nine per cent of the cases. One woman probably has a submucous growth in addition to what was a large retroverted tumor. She was a bad surgical risk. After seven series of x-ray she had two thousand four hundred milligram hours of radium. Three months later she suffered from one of her worst hemorrhages. After waiting five months for results we resumed x-ray. Recently, following the twelfth series (covering more than two years) we seem to have made substantial progress, but anticipate more radium. The patient's general health is greatly improved and emaciation has given way to normal weight.

*Read at the annual meeting of the Radiological Society of North America, Chicago, Dec. 7, 1921.

It is always wholesome to analyze the causes of failure and below are some suggestions:

First: Failure and discredit come to us because of the too common practice of treating the patient without an examination which exactly locates the tumor and estimates the pelvic condition in general. One woman who reported to me had had several groups of roentgen ray treatments owing to persistent recurrence of the symptoms. The roentgenologist at no time examined the patient and did not know that the tumor was extremely retroverted and prolapsed so that the ray, always applied just above the pubic bone, and passing through an obese abdomen, barely reached the tumor, and, of course could not do full curative work. It is not surprising that continued x-ray was not favorably considered, and extirpation followed. I am now treating another woman, once discharged as cured by a roentgenologist who had never made an examination. These errors, like accidental burns, are avoidable and bring a distinct reproach upon our work as a scientific body.

Second: In general there is lack of thorough systematic raying continued beyond the time when menstruation ceases. In the average case not less than five or six series can yield the best permanent results. In obstinate cases the treatments should be continued cautiously as the exigencies of the case require. Twelve series (extending over two years) is the most I have given.

Third: Judging from my observations and reading, I surmise that the average operator is too casual in his diagnosis, his technique, his general conduct of the case and especially in his estimate of end-results. The treatment of so serious a malady is not a casual business, but implies intensive work and vigilance.

In making a survey of one hundred cases you can appreciate that it has been impossible for me to follow personally each one. I have arrived at my conclusions by a careful record showing the character and tendencies of the tumor, by a knowledge of the condition at the termination of treatment, by a determined "follow up" campaign, and by conferring repeatedly with the physician who referred the case. A large majority of the cases submitted today have had confirmatory diagnosis made by other physicians.

Two and a half years ago I reported to you my first thirty consecutive cases. At that time fifty per cent of them had no demonstrable tumors. Today the same thirty cases show fully eighty per cent without tumors. This fact illustrates that time is our most important

ally. After all treatments are ended the tumor continues to recede for months or even years, though it may need occasional encouragement.

The first sixty cases show seventy-eight and one-third per cent without palpable tumors. The last forty cases show only nineteen without tumors, or forty-seven and one-half per cent. Judging from the first sixty matured cases, this group contains several that will enter the no-tumor class.

As you will see, the last forty do not make the good showing that the first sixty made, mainly because the more recent cases are not matured, and because we have undertaken more difficult cases in which the prognosis was much in question. All of these understand the uncertainties attending their treatment. It is doubtful, however, whether it is advisable to accept such cases.

It is logical to inquire what is the status of those cases that still have demonstrable tumors. In answer I am glad to say that the great majority of them are "symptomatically cured," that is, the tumor is so reduced that the patient is not conscious of its presence. It is freely movable, the menopause is established and the woman is in good health.

The remaining cases are accounted for as follows:

Two immense tumors, one the largest of the series, the other very large and most unpromising, have been much reduced in size, and symptoms have been so completely remedied that both patients have recently committed themselves to matrimony.

One case encountered a gonorrheal infection which necessitated operation. This is included because it illustrates that while x-ray does no harm to these cases, neither does it do good, and the infection runs its natural course.

One, aged thirty years, had a myxomyoma, that unusual condition which is rarely diagnosed except after extirpation. Though the case did not respond satisfactorily to x-ray, her physician and myself were so confident as to the diagnosis that we gave the fourth series, excluding the ovaries as much as possible. The presence of the Wharton jelly-like substance (revealed by operation) explained the failure of x-ray. This woman has recently been delivered of a child at full term. The infant died on the fourth day—cause unknown to me. Though this one woman conceived after x-ray, that hope is no longer held out to any one. The cases on record are too rare. ⁽¹¹⁾

Roentgen treatment in one case greatly reduced the tumor and gave much relief, but this case died one year later of chronic heart disease.

Two cases discontinued treatments too soon and so remain in status quo, two we cannot trace, three problematical cases must have time to develop the facts.

It gratifies me to state that none have developed malignant symptoms. This fact authorizes one of the following conclusions: either malignant growths do not complicate fibroid as often as certain statistics indicate, or else the roentgen rays remedy the precancerous state, and arrest the incipient carcinoma or sarcoma that has escaped detection. Probably both are true.

In twenty-two years of gynecological practice I have never seen, to my knowledge, a sarcomatous degeneration in a fibroid and have seen but two fibroids complicated by carcinoma. My experience is apparently in accord with the experience of many of my confreres and is not widely at variance with those who report recent laboratory findings.

From the records of The Presbyterian Hospital, New York City, sarcoma occurred twice in three hundred and fifty cases of fibroid operated, or one-half of one per cent. ⁽⁶⁾ From the Mayo Clinic Evans reports seventy-two in four thousand cases, or one and eight-tenth per cent. ⁽⁷⁾ From Mt. Sinai Hospital, New York City, Geist reports twenty-two sarcomatous cases in five hundred and forty, or a little over four per cent. Geist further says:

"To my knowledge there are no cases in which after or during the roentgen treatment a malignant condition has developed locally. It cannot be argued that the bad results have not been recorded, and we must, therefore, alter our point of view as regards the roentgen ray treatment of fibroids. If after irradiation and prolonged periods of observation, no malignancy develops in the uterus and no metastases occur, then we are bound to say, not only that the roentgen ray causes a beneficent result in fibroids, but also in cases complicated by sarcomatous change or those cases of sarcoma not diagnosed." ⁽⁸⁾

An excerpt from an article by Dr. John G. Clark is as follows:

"The next danger, that of sarcomatous transformation of the myoma, is also stressed with much gravity by many writers, but the cold laboratory records very greatly chill this side of the discussion. The fact is that sarcoma is seldom a degenerative or concomitant evil of myoma. Based both on clinical and on laboratory conclusions, therefore, we deal with fears solely within the domain of fallacious supposition in discussing the dangers of sarcomatous changes of myomas and fibroids." ⁽⁴⁾

In the presence of these authorities, and many others, it is obvious that the

fear of sarcomatous degeneration should not deter from the use of x-ray; and to frighten a woman into operation by telling her that she is in danger of cancer is neither wise nor right.

Our technique has not materially changed in five years. We still hold to the cross-fire method: Coolidge tube, nine-inch spark gap, seven-inch skin distance, five milliamperes, four to seven minutes time.

For about two years we made the experiment of increasing the dose from ten to fifteen milliamperes minutes for each port of entry by increasing the time. We also increased size of port and reduced the number. Result—intense tanning of the skin with occasional peeling, patients suffer more from nausea and malaise, reduced buoyancy and confidence, the joy of getting well is conspicuously overshadowed. To my disappointment nothing was gained by the experiment. In fact, my first sixty cases were my banner cases. Comfort and a feeling of well being are very important to the patient, and if these can be maintained while the tumor is reducing satisfactorily there are distinct advantages. It is true that one large single dose may at once establish the menopause, but in general is not that one of the greatest arguments against it? My preference is to give time for readjustment and thus avoid shock and a stormy menopause.

Routine examination of the spine reveals that fully sixty per cent of the cases herein reported suffer from deviations, especially at the lumbo-sacral and the sacro-iliac joints. I am convinced of the following: That the slow recovery in some of these cases is due to the persistent congestion of the pelvis which accompanies this condition; that the severe back ache and pain extending down the legs are not always due to pressure from the tumor, but to this interference with normal poise; that tumors may even be caused by the intense chronic congestion accompanying this accident to the bony framework of

the pelvis. Whether this factor is etiological or not it is a complication to be reckoned with. My convictions have been verified by the response of the delayed tumor to treatment which reduces the mechanical defect and improves pelvic circulation both in blood vessels and lymphatics. This argument is far from conclusive, but it is suggestive and orthopedics may have a place in some of our severe cases. To employ helpful adjuvant measures is as logical in this specialty as in general medicine.

For the following reasons we have preferred x-ray to radium in the treatment of fibromyomata:

First: The roentgen ray works more slowly than radium; the menopause is not precipitated, but may require two or three months before it is established.

Second: The roentgen ray reduces the large tumor more successfully than does radium; the tumor coming to the umbilicus, if otherwise favorable, yields satisfactorily to roentgen ray, but would be impracticable for radium. So far as I can determine by reading little is said by radium exponents about the disappearance of tumors, small and uncomplicated as they usually are. Relief of symptoms seems to be the result sought and obtained in a large majority of cases.

Third: Roentgen ray can be successfully applied without loss of time, inconvenience or discomfort. Radium treatments require an anesthetic, from two to seven days in the hospital, and considerable uncertainty and suffering. It is a comparative ordeal, especially if the treatment is repeated two or three times, thus multiplying the periods of incapacity.

Fourth: The danger of roentgen ray in experienced hands is negative, while radium in the hands of the best radiologists may be followed by alarming complications and sometimes fatal results. Dr. Graves, professor of gynecology, at Harvard, says: "Too great emphasis cannot be laid on the danger of making intra-uterine radium applications in

the presence of pelvic inflammation. Even though the active inflammatory process existed years before, and there remains only a few peritoneal adhesions radiation is attended by risk. Inasmuch as an old inflammatory process is sometimes missed both in the history, and with the most expert preliminary pelvic examination, it stands to reason that even with great care occasional untoward results are sure to be encountered; and any one who says that intra-uterine application of radium (in bleeding) is attended with no danger knows little whereof he speaks." Two cases cited died from sloughing.

In conclusion: It is surprising that thousands of women, under the sanction and advice of their family physician, are still undergoing operation without being offered the information, to which they are entitled, about the roentgen ray. Time is proving that the roentgen ray has no rival in good results, easily accomplished, with no accompanying penalties.

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EDITORIAL

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A Scientific Renaissance

The post-war review with all its gorgeous trappings and misery, its unlimited satiety and shameful starvation, its luxuriant robes and pitiable rags, its unctuous virtues and damnable intrigues, constitutes a panorama which either congeals a man's blood because of his individual helplessness, or makes him sneer with derision and mockery at the utter emptiness of the shrine called civilization.

Social questions and scientific problems are being vehemently cast into the teeth of the four winds by the ultra-radical: they are being discussed broadly and fearlessly by the scientist: they are being studied painstakingly by the sociologist: they are recklessly banded about in guarded and high-sounding terms by the politico-economist, or perhaps more correctly, the economic-politician: they are the subject of prayer and fervent discourse by the theologian: and the dear people, who always pay the bill, are trying laboriously and earnestly to learn where they go from here.

The fact is, everybody is having a fling at the job of juggling the present social chaos into an orderly picture so far as human intelligence makes that possible. The best minds, and the worst, measured by an abstract social code whose obsolescence is already decreed by the forces of intellectuality, are trying to prove that it is both possible and practical to keep the collective feet on the ground and the hydra-head of society in the clouds. They are trying to interpret the push and the pull of human affairs, and write out a mode of procedure which will definitely guarantee human progress by the clock.

A few references may serve to prove the point.

The disarmament conference has had a big try at establishing the future stability of society. At the moment of this writing, a world economic conference is about to be called. Periodicals by the dozen, including "The

Survey," "The Nation," "The New Republic," "Century," "World's Work," "The Saturday Evening Post," and scores of others, are at it hammer and tongs if they happen to belong to the radical group, carefully and with measured tread if they chance to lean to the scientific side, or conservatively if they belong to the intellectual type.

And of books on the subject in its myriad ramifications, there are already legion. Witness a few: "The Social Problem," by C. A. Ellwood, Professor of Sociology at the University of Missouri; "Sociology and Modern Social Problems," by the same author; "A Philosophy of Social Progress" by E. J. Urwick, M. A., Director of the School of Sociology, London; "The Foundations of Personality" by Abraham Myerson, M. D., Assistant Professor of Neurology, Tufts College Medical School, Boston; "Social Theory" by G. D. H. Cole, Fellow of Magdalen College, Oxford; "What Christianity Means to Me," by Rev. Lyman Abbott, of New York; "Elements of Sociology" by Franklin H. Giddings, M. C., Ph. D., Professor of Sociology, Columbia University, New York; "Vital Forces in Current Events" by Spears and Norris of the Department of English in the United States Naval Academy; "Democratic Ideals and Reality" by H. J. MacKinder, M. P., former Director London School of Economics and Finance; "Sociology—Its Development and Applications," by James Quale Dealey, Ph. D., Professor of Social and Political Science, Brown University; and "The Unsolved Riddle of Social Justice," by Stephen Leacock, B. A., Ph. D., Litt. D., F. R. C. S., Professor of Political Economy at McGill University, Montreal.

So it is, that whether a man travels from Paris to London by air, walks the streets of Berlin, takes part in the mad scramble for food in Russia, rides in the subway at New York, or attends a farmers' congress in Nebraska, the same questions are discussed. He hears something about Irish freedom, something about Russian relief, something about exchange rates, something about war debts, something about taxation, and something about high prices of the things men buy and the low prices of those things they sell. And nearly always, too, if the discussants happen to be men of family the conversation ultimately drifts into an exchange of intimacies about the baby, while if they happen to be unattached and fancy free, there usually develops an *ex parte* proceeding having to do with the merits or demerits of certain new fangled devices or methods introduced into this or that particular line of industry.

From which it may reasonably be inferred that there are two things uppermost in every man's mind: (1) the question of his own and

his family's health; and (2) the possibilities contained in the application of all manner of science for lightening his individual burdens as a member of society.

A review of the current literature is sufficient to prove the strength of this assertion. It makes no difference, in the last analysis, that up to a certain point each author meticulously follows that primrose path which in his judgment is best fringed to stage his argument conclusively. It makes no difference, in the end result, that from that point each proceeds in a delirium of ecstasy, spiritual mysticism, or cold logic according to which is best suited to the particular magic sought to be invoked as the solvent of the riddle which is now confounding the world.

It is not the purpose of this discussion to join issues with any author, or to lay down a divine *ipse dixit*. There is, however, something strangely fascinating, one might almost say prophetic, in the fact that every discussant grounds his theories and his hopes in two things, i. e., science and health, and of the two, the potentialities of health preponderate.

This fact justifies a few deductions and warrants some comment concerning the future of science in its relation to the question of public health. For when all discussions merge and flatten out on the proposition that science and health as separate factors in our social fabric are of fundamental concern; when it is argued that science is too abstract and too inhuman, and that each is both cause and effect in conditions which are not only unsocial but individually intolerable; when the radical condemns science because it is unhuman and the conservative recognizes the inviolable right of men and women to the blessings of health; when the scientist admits his own scientific failure because he has not been able to lengthen the span of his own life appreciably or overcome his own physical limitations; when the theologian is blessed in the presence of health whether it is founded on science or natural law, and confounded when he approaches the sick-bed; when the philosopher solemnly proclaims himself the possessor of powers beyond anything of which science is capable, and then illustrates the principle of *reductio ad absurdum* by insisting on receiving the services of scientific men in the first hour of physical and mental agony—when all these crazy anomalies occur every hour of every day, an enormous responsibility is laid on scientific achievement.

II.

Science, of course, needs no defence. Its record in industry, in commerce, in matters of health, is such that no man can be wholly oblivious to its accomplishments. No matter how unfamiliar a man may be with the inner circles of science, it requires but the mention

of a few notably scientific men—for example, Bell, Edison, Burroughs, Burbank, Osler, Pasteur, Rosenow, and numerous others whose niche in the development and enjoyment of human life is sustained by noteworthy attainment—it needs but the mention of these to send even the average man headlong into an outburst of commendatory praise and thanksgiving.

Viewed in its relation to the future social structure, it is incontrovertible that true science has, by its own record of meaningful service, set itself a stupendous job. At the present moment all hands seem agreed that science holds, or at least seems to contain, the only dependable anchorage for the leaky ship of state, the hard tossed raft of universal social stability, and the battered hull of public opinion.

Men and affairs are fluid. They have been torn loose from the old moorings. They are, as a consequence, in a very real sense adventurers. They are dreaming of, and talking about, a new world. And these fleeting visions they conjure out of the disappointments of the past and the hopes of the future prove so alluring that they refuse to return to those muddled relationships which caught them up, and carried them irresistibly into that vortex of confusion which was the climax of social and governmental complex as against which they had been unable to provide any relief. It makes no apparent difference that this lack of social cohesion and large social purpose is responsible for confusion worse confounded. For the moment, speaking broadly, men are content to hold themselves aloof from fixed social habits as much as possible because in that they find the privilege of viewing things as they are; because in that detachment they find some hope of changing the social status if ever so slightly, to make it the more nearly conform to those ideals which have come up with men through generations of adversity, human suffering, and political horse-trading.

Consequently, the job of setting up anything like a decently comprehensive statement of the present social problem in its entirety is an absolute impossibility. Even to touch some of its minor phases is a mighty perilous undertaking. One is certain to find himself involved hopelessly in an overwhelming torrent of facts and fanciful ideas, all of which enter into and have some influence on the composite social structure. And more likely than not, if the man who attempts the introduction of orderly purpose into the social structure doesn't have a hide sufficiently thick to make him absolutely impervious to personal insult, he will soon become an alternately laughing and weeping idiot because no man lives who has sufficient intellectual power and prescience to grasp the whole problem and reduce it to specific terms. Human relations are dynamic, disconcertingly dynamic, so that before one state of facts has been assembled, let alone sorted and studied through, quite another and different state is in vogue.

For these and many other obvious reasons, the sensible thing to do, indeed the only

possible thing that can be done, is to determine whether there is a common fundamental principle involved in all the aspects of human effort; and if there is such a thing, to strip it clean, and hold it up before the minds of men until it has become a ruling passion of public opinion. Such a course is justified, because it is axiomatic that, in any great social upheaval, if one single item of common interest, common agreement, and common appeal can be found, a clarion call to the rank and file of people everywhere will not fall on deaf ears peradventure that call be full-throated and sincere.

This is the opportunity and the obligation of scientific men, who should, as the result of their methods of thought, be able to chart the trend of affairs. For people generally are becoming conscious of the fact that unity of purpose is necessary, in the first instance, if society is to be saved, and in the second instance, if humanity or civilization is going to devise anything like an orderly and intelligent process of growth physically, mentally, morally, and economically.

It is not contended, of course, that the millennium is just around the corner. We do not entertain any hope that all the petty personal bickerings and controversial traits of human nature everywhere can be removed by the simple single expedient of a catchy slogan or a scientific investiture of the basic organizations of society.

But the disentanglement proceedings of the after-war clutter are more than the ordinary social scramble. It is the biggest crisis in history. It affects everybody everywhere. Some are suffering intolerable hurts. Others are moaning from sheer sympathy. Others are weeping and gnashing teeth simply to keep up with the fashion.

However, the fascination of social uncertainty and individual detachment from everything which symbolizes law and order and common habit is beginning to lose its glamor. First aid has been rendered in a million different ways. Men and women are beginning to stumble along the rugged path so lately blasted by the irresistible forces of common purpose. And as they grope along, struggling always to stand erect, there will develop in men's minds an increasing belief that after all, science is not purely a destructive thing, but that it can, by comprehension, understanding, and sympathetic direction, be made to serve human beings physically, economically, mentally, and spiritually in a bigger, personal and more decent human way.

The outcroppings are numerous and unmistakable. All that is needed to give the forces of social ferment direction is a master mind, composed of the best of all individual minds, actuated by vision, courage, and bounding human sympathy that will give it the mental stability to fling the burning torch of reason into the strangely combustible structure of public thought.

But whether it comes in the form of a sweeping reformation of our social fabric, or grows slowly and laboriously to full stature

through the costly and painful processes of experimentation, this one thing seems certain, and that is, science is facing a renaissance,—a fundamental reconstitution which will seek to preserve all of the hypotheses, theorems, calculi, and methods of abstract precision, and at the same time rip away all the impediments of tradition and divisional purpose, bind all science and scientific agencies into a cohesive and coordinated and constructively functioning unit, and breathe into the whole a vitalizing and warming spirit of large human service.

III.

If then, science is to preserve the warp and woof of its integrity, if it is to broaden its field of usefulness commensurately with social need by perceiving now the obligation which is being so unmistakably written out to measure its future conduct; if those men who proclaim its potentialities are influenced at all by the social concept of the elements of science which is being unalterably prepared by a distraught world and which may prove to be an epitaph quite as easily as a birthright, scientific agencies must of their own free will and accord, and with deliberate purpose, begin now seriously to construct an inclusive working plan which will contain some promise at least of a fair measure of attainment of those vital things men are thinking about. This is the larger part scientific men are going to be asked to assume in social affairs. They will be obliged, collectively and individually, to recognize that industrial processes however promising financially, that child welfare no matter how essential to any particular section, that old-age pensions, implements of war, and hundreds of others which might be mentioned, are but incidents in the larger theory they must evolve to cement the whole social organization and make it more nearly representative of the composite welfare of world society.

Cutting away all of the disputatious matters which are so easily injected into a discussion of this kind, and getting down as quickly as possible to the one outstanding premise which is common to all science else it must ultimately fail as a social instrument, it is entirely safe to assume that the whole scientific structure of the world must be reared bit by bit on the foundation of public health.

That premise insures the scientist a safe beginning and immediately brings to his aid all manner of workmen whose willing hands the scientist can employ and direct in building the common social edifice wherein will ultimately and permanently be housed the sociologist with his intimate knowledge of political institutions, the theologian with his spiritual interpretation of life, the economist with his arbitrary rules and regulations designed to establish safeguards for property and provide the necessary buffer mechanisms to insure an equilibrium between supply and demand, the statesman with his dreams of community interest, the industrialist with his pots and pans, and the professor with his eyeglasses and scratch-pad. In this way, and in this way only, can science be everlastingly established

EDITORIAL

in the rotunda of all human relations, not in the sense of dictator but as privy counsellor and friend.

And because of its broad knowledge of and intimate contact with, human life and health, medical science is peculiarly shoved into the foreground as being impressed with the desires of the human family and translating them into human scientific equations, finding their solvents, and out of these, fabricating a philosophy of health which will bind all men without savoring either of paternalism or obligarchy.

Naturally, many questions will be raised by narrow-minded persons about the relative importance of chemistry, metallurgy, biology, physics, engineering, and so on. But these are minor questions which will disappear when a really comprehensive effort is made to bring to the problem of health a coordinated, correlated, and synthesized scientific approach. Each branch of science as it is now known, and as it shall be expanded to meet the requirements of any such program, will find its sphere of labor and responsibility so great, and its work so absorbing and far-reaching, that anybody, save he be a hopeless bigot, will recognize that each divisional unit is equally essential to the success of the whole, and that none can function fully or intelligently except by means of harmonious and unlimited collaboration with all the others.

One might illustrate this proposition by calling attention to the interdependence of medical science and the science of chemistry. Certainly no medical man will be heard to say that he could practice his profession satisfactorily, humanly, or effectively without calling to his aid the products and laboratory skill of the chemist. And contrariwise, that chemist is a fool who has the temerity to assert that his is the dominating science and thereby inferring that the important problems of yellow fever, the black plague, malaria, pneumonia, and many other scourges known to humankind, could have been, and would have been, solved even through the science of medicine had not, after years of sacrificial study differentiated them and set them up as specific problems for attack and solution.

As we see it, the question of public health is no place for contentious elaboration concerning the superior importance or relativity of this or that particular branch of science. It is rather a question of such magnitude and vital concern that all truly scientific men will gladly extend the hand of fellowship to every other scientist in a sincere and deliberate effort to conceive some plan for the amelioration of human suffering and the prolongation of human life by the intervention and application of preventive methods.

The thing any serious student of this problem must acknowledge is that the medical profession, with all its weaknesses, fallibilities and organic failures, represents the point of scientific contact with the human family in a more intimate and comprehensive way, and because of its ideals and past achievements it is devoutly hoped, in a more understanding

and human way, than any other body or organization of scientific men. This statement is not made in a spirit of contention. But it seems necessary again to record the fact which supports the profound obligation medical men are striving earnestly to fulfill.

The apparent confusion of purpose among scientific men is perhaps accentuated by the further fact that within the past few years, medical men have come to appreciate fully their physical and mental incapacity to encompass all of the collateral sciences and apply them to the problem of the public health. They have also learned to appreciate the absolute right of the patient in whatever strata of society, to the benefits inherent in all science. Struggling always to accord men and women everywhere the fullest expression of scientific attainment, and laboring tirelessly to explore the fields of promise which they see forever broadening as their scientific horizons are lifted by exact knowledge, the medical profession long ago learned the value of sharing its burden by calling to the service of suffering humanity all kinds of scientific men, calling them too, not as underlings or hirelings, but as co-laborers in a field of activity where the responsibilities and possibilities are great enough for all.

That mutuality of effort is now about to be extended a little further. For with the advent of preventive medicine as an integral part of medical science, it becomes more and more obvious that intelligent and effective ministrations to the health requirements of millions of men and women everywhere, engaged in all sorts of occupations, and representing all stages of physical, mental and spiritual development and capacity, means a constantly increasing search for the unknown potentialities of all science, and a thorough-going collaboration with those branches peculiarly devoted to the psychological and sociological aspects of life. In no other way will it be possible to achieve a binding philosophy of health, embracing all and benefitting all.

IV.

These are the beliefs, the motives and the aspirations which actuated the establishment of a Research Department by The Radiological Society of North America. They are, also, the ideals, the spirit, and the purpose with which the work of that department will be conducted.

Naturally, much that has been said is general in its terms. It is impossible to discuss the broad phases of this problem otherwise. But the outstanding effort of the department will be always to specifically apply the principles underlying social welfare whether those principles be now known or shall at some future date be fixed.

To this end, as time and organization permit, specific studies will be conducted in sociology and medicine for the purpose of determining the etiological factors of disease. Other studies will be made as rapidly as possible of the various economic and social influences on biological conditions. Another feature will be a survey of the entire medical pro-

fession for the purpose of establishing a composite representation of medical opinion on various phases of medical science, and for the further purpose of getting from the profession at large its views and data concerning what should constitute a real constructive program of preventive medicine.

Speaking now of the peculiarly scientific side of the matter, an early attempt will be made to compile case report data from every source on the North American continent,—and later by cooperation with similar organizations in all parts of the world, it is hoped, like data from every available source. This will mean that the information thus secured will be classified according to disease, clinical history, pathological findings, treatment rendered, technique, subsequent length of life, and post mortem findings if any.

The importance of this information will be readily apparent to all medical men as well as others interested in scientific work. It is of especial interest, because it will, when fairly enough established to be representative, lay a proper foundation for strictly scientific research having for its object the determination of the question of the action of radiation on the tissues.

Many, many other things might be recounted which will fall within the province and the labors of this department. But it is believed a sufficient outline of the kind and the importance and the scope of the work being undertaken has been given to convey an idea of the earnestness and large purpose which this organization brings to this socio-scientific problem.

It goes without saying that conjunctive action along kindred or remote lines which will be helpful in any way in the study of this important question will be welcomed and suitably recognized.

Much of the work rather hastily sketched will require infinite patience and painstaking labor as well as occupy an amount of time not calculable with precision in advance. But there must be a beginning. The obligation is certain. The necessity is imperative. The time is propitious. The world is calling. And science has in its keeping the working machinery which will find the remedy for many individual and social ills.

Radiological Contacts

THE constitution of the Society, it seems, requires an annual address. In this there must be the usual effort to solve all our problems and since, by the courteous consent of all, the chairman is cloaked for this one occasion with keener insight on present status and future problems I accept the nomination to this annual folly with the hope that my remarks may later generate riper discussions.

Is the radiologist a specialist? There has been a running argument along this line for many years. The majority of us have rather sketchy ideas on this subject but we should nevertheless try to develop convictions regarding the niche we fill in the medical world. Every day we have definite problems to solve.

EDITORIAL

We go on making plates, buying books and apparatus, quoting each other—and wondering why we are not asked in for consultation on the final diagnosis. True, our plates and reports are there for the other specialists to glance over but we may be putting away in the dark room. The wise man, not satisfied with his environment, orients himself sufficiently to discern his difficulties and then either removes them or seeks a different environment.

A little resume of radiological history may help us to understand how we arrived where we are today. At first weak in physics, in technique and in pathology, radiology looked longingly out along the path—the steps from platinum to tungsten, from guess work to meters, from radiogram to post mortem were logically made. To name the men who guided this formative period would draw heavily on the early membership of the American Roentgen Ray Society. It would touch every man who has received an honor here tonight.

While our pioneer helpers were widening the field of diagnostic possibility, from bones and foreign bodies to peristalsis and soft tissue pathology, we stood out of the way of scattered radiation and read it all. Progress was made and the younger men were in it and of it. Knowledge of sinus, mastoid, kidney and pelvis, experience in plating, pituitary pathology, gall stone successes, pneumoperitoneum adventures—all these are credited to the younger men as well. The history of therapy has taken almost the same course. The older men speak with pride of their longer cures, while the younger men rush the harder after the greater sphere gap.

As a premise let us grant that we have all arrived—radiologists. We should not judge the radiologist as a friend of mine in the east did by asking "What has he ever written?"—nor as one in the west did the other day by asking, "What is his income?" A good radiologist, just as a good missionary, must be a sincere production but his foundation cannot rest on fervor and vision alone. Imagination and enthusiasm must be held in check and he must build upon the foundation laid to become an efficient doctor of medicine. If he has not been well grounded in anatomy, physiology, chemistry and pathology he is out of the running. If he has not the usual medical skill in weighing clinical symptomatology and in judging the ordinary possibilities of therapy and surgery he will be handicapped. Finally, if he is to attain the title of a really good radiologist and fully develop his specialty, he must study the new physics of radiant energy, pick up all the wrinkles of photography, acquire new knowledge of dermatology, dental pathology, orthopedics, and the other medical specialties. Besides this, if he is to be successful, he must develop business sense to take care of his overhead, and medico-legal caution to guard himself and his specialty. Whether he should also be a good politician is left open to discussion.

Although it has taken many words to discuss the requirements of a good radiologist, it

might possibly be put in a fairly brief statement as follows: A good radiologist is a man with a good medical education, who serves the public and profession of his community conscientiously, rendering the added diagnostic and therapeutic radiological aid with reasonable skill wherever legitimately required.

Granted that one has so developed, should he be satisfied? As long as some of the medical profession still say that only bones can be seen by the x-ray, as long as laymen ask for radium pills, and members of the American College of Surgeons make general statements disregarding and disrespecting the consensus of radiological statistics, so long must the radiologist do his bit of missionary work in organization. A missionary is a propaganda distributor. Conferences, congregations and conventions are for his help. Here he preaches the good of his cause and warns against sins of various kinds that are wont to develop. If his creed is one of too many dogmas his success will be narrow. If his organization becomes a closed corporation, his usefulness will be limited.

If his gospel purports to distribute universal helpfulness and to represent a broad geography, then the converts should be many and the membership large, the constitution democratic, with a machinery to prevent too small central control. His organization then becomes his teacher and by its mass opinion, becomes his protector before the public, and sponsor toward other medical specialties. Whether he remains a general radiologist or emphasizes a special field, depends upon the demands and possibilities of his location. If he is to be a good general radiologist in a populous district, he must be a wonder. His mental task of doing a quantity and quality of work in all the anatomical specialties demands familiarity with such a volume of new developing literature as few can hope to attain.

Should he do this, as almost none have done, what energy or time has he left to puzzle over his complicated contacts with the social public, the state legislature, the family patient, the referring physician, the clinic, the hospital, the college? To discuss each one of these contacts in detail, tonight, would be a travesty. A few points, however, might be brought up.

Regarding contact with the social body I recall the following bit of history in the form of a committee report adopted in 1907 by the American Roentgen Ray Society. It reads as follows: "The proper fees to collect for x-ray work:—Vesical Calculi, \$50.00 to \$200.00; Chest, \$25.00 to \$100.00; Shoulder, \$25.00 to \$50.00; Stomach, \$75.00 to \$200; Foot, \$15.00 to \$50.00; Teeth, \$75.00." The members tried to live up to this for a number of years and it may have been a mistake and may have injured our standing with the public and the referring physician. Our own organization should watch its occasional overcharges for radium and deep therapy. Radiology, like other branches of medicine, has a definite social aim. It is one of the public utilities and if not administered reasonably

may be taken over by the State. If this happens it will inevitably lack the scientific genuineness of the present.

Radiology, which includes radium therapy, is a new science and must combat the over antagonistic knocks of the aggressive surgeon as well as misquotation in the lay press. On Oct. 24, 1921, John Blair Deaver, M. D., at the congress of the American College of Surgeons in Philadelphia made the statement that radium cured only certain types of superficial cancer. On Oct. 25th, the Associated Press report read as follows: "Radium as a Remedy for the Relief and Cure of Cancer Has Failed." As a society doing work in this special field we know that many cases of otherwise hopeless cancer have been relieved by the use of radium and we should not stand silently by and allow the fire of hope to be dashed out with one public splash.

State boards must be convinced that radiological practice is medical practice and must be brought under the medical practice acts. In some states non-medical technicians are permitted to make diagnoses and to practice irradiation therapy. In other states the x-ray outfit embellishes many a chiropractic's office. Our organization should encourage an educational mass action directed toward correction of these abuses. I understand that very recently in the east several government contracts have been given to lay technicians.

In dealing with the referring physician, we should try to develop his understanding of our place in the diagnostic circle, and his appreciation of the technical difficulties and negative possibilities. He should be calmed into allowing us to say "I don't know" once in a while or to accept from us the same as he perchance may be obliged to give—a personal opinion—for what it is worth among the preponderance of data—the correct answer to which perhaps the Lord only knows.

Dr. Pfahler in 1910 at Detroit said: "In order to gain the confidence and support of the public and the profession we must show ourselves worthy of it, by being thorough students. We must eliminate guess work and either state absolute facts or say we do not know. Pathological conditions vary so much in extent and character that we must not be too dogmatic. The clinical symptoms and x-ray shadow often give more than one possibility."

Let us hope that if we are connected with a group, it will not be too small a group. Our wings must not be clipped by salary considerations or clique decisions if we can develop strength to fly. Let us feel if we are associated with a hospital, the rare opportunity for correlation and follow ups. Let us be sensible of the tragedy of wasted opportunity and loss of clinical records. If no other department supplies a camera for visual records, lantern slide making, etc., let us do it ourselves even at the possibility of being called photographers.

If the College of Surgeons is really standardizing our hospitals let it demand as a minimum that the radiological laboratory be the responsibility of a medical radiologist. No

EDITORIAL

more important department exists in the hospital, because it assists all other departments in making diagnoses and renders valuable aid in the treatment of disease. If complete it is necessarily expensive. This need should be explained to both trustees and the public and they should be made to feel that poor equipment and cheap technique means debauches of error and bills of disaster.

The contact of radiologist and hospital staff members forms a side problem. Barclay, of Manchester, feels that the radiological laboratory can be made a congenial meeting place, with afternoon tea as a possible aid to greater good fellowship and better work. This scheme may not be practical in America because of different social customs but it offers a suggestion. The division of interests becomes less as our associations become closer. The standpoint of other medical specialties can better be studied in an atmosphere of good fellowship,—and the horns on our bread and butter competitors will atrophy. When a competitor, local or otherwise, does good work we should support him and praise him. He is not lessening our future income but building up confidence and worth in our field and increasing the general demand in which we all will profit.

We have been accused of working for profit, of working "for what there is in it." Yes—we might plead guilty if by profit were understood something that means more than money. Total profit includes a feeling of mental growth, increase of technical skill, an understanding of and sympathy with the needs of the community, and a sense of worthy satisfaction. These are things that money alone does not bring to us.

We are proud of the present status of the Radiological Society of North America. The organization by mass feeling is developing more harmony in scientific controversies and in working out its problems. The pendulum of discussion is swinging less and less and coming to rest more and more on such discoveries as direct duodenal diagnosis of Cole, the meaning of the apical fan of Dunham, the value of the diaphragm principle of Potter, also the non-significance of dropped stomach as emphasized by Mills and ileocaecal value incompetency as discussed and dropped by Case. Other problems are still enjoying a wide swing. Among these are pathogenesis of gastric ulcer, method of lung cancer infiltration, meaning of sella turica, mastoid and appendix findings. The radiologist will probably soon be obliged to go outside of his specialty to find things to quarrel over—for the brakes of parallel work and group scrutiny have been applied to all visionary and over enthusiastic deductions.

We must admit that up to 1915 radiologists were insufficiently organized. According to statistics, gathered by Watkins of Phoenix, only fifteen to twenty per cent had joined any organization at that time and during the five previous years there had been only sixty who had done so. By way of emphasizing the evidence of the recent rapid growth of radiologists into organizations we may note that in

1915 the American Roentgen Ray Society took in only sixteen new members at its sixteenth annual convention at Atlantic City. In 1920, five years later, the Radiological Society of North America took in two hundred and eighteen new members. This year two hundred and fifty new members were added. We are not afraid however of becoming top heavy. The program of this convention gives us a secure feeling that the older members who represent the roots and main growth will be equal to the strain.

I make no mention of problems for the incoming president, Dr. Soiland, to attack. I have great trust in his discernment, energy and ability.

I cannot take the time to mention in appreciation the sources of my help during the year. It would name all my councilors and fellow officers. Mine has not been the push or pain of the pioneer, but I wish you to know I have been fully sensible of the support, loyalty and honor you have all given me.

Alden Williams, M. D.,
Grand Rapids, Mich.

*President's address read at the Annual Meeting of the Radiological Society of North America, Dec. 8, 1921.

The Future of Medicine—The Ideal to be Sought

I wish to quote to you from Conway:

"To a human being his ideal represents his individual existence. One life we each have, which is merely hereditary. We receive it from our ancestors, we share it with others; it is common property. There is another life which is our own. There each stands in the presence of his own Sinai, receives the Tables of Law of his individual life. To him there comes a Decalogue of private interpretation and the command—'See that thou do all things after the pattern thou didst see on the Mount!' So indeed must he work—if the world is to be better by a feather's weight for his life in it;—so must he build, quarrying his hereditary nature, polishing it for his individual structure. Nor shall he pause to ask whether the edifice is to be completed and adorned, and, labor give way to happiness. He cannot reach the great end, because there is no end; the scale is infinite; so have the poets said who reached the seeming summit, only to behold a higher height rising before them ever more. Let it be enough for each that the genius of God finds no obstruction in him; that he is part of the organizing force of the universe—as much as the coral building in the sea, the sun that vitalizes a world. And when the day is past and his bit of work is done, the ideal he has served will whisper a sweet and secret joy—'Thou hast labored, and others will enter into thy labors.'"

How truthfully this applies to us! Is this not an expressive keynote to govern us and to dispel the chaos in which we find ourselves? Does it not formulate the ideal for the future of medicine—a solution as to the part each must assume?

Our science has made rapid progress. The public perceives the power we possess to conserve and prolong its physical well-being. Knowing, it demands the benefits of that power. No individual can become expertly proficient in the application of all scientific knowledge. The average lay individual cannot afford to purchase these benefits unless we correlate the cost with his ability to pay. His love for his offspring may cause him to incur a single sacrifice, the result of which will bring him greater disaster than the occasion involves, and assume an obligation beyond his financial responsibility. He will not do so repeatedly at the cost of his independence. It is when we compel such repeated sacrifices that he will through his legislators demand that the state grant to him that which we make it impossible for him to secure. It is for us to make available to the average layman professional services that will protect his physical welfare and at the same time provide for ourselves emoluments that beget to us and ours a competency which will provide life's comforts and joys. Veritably a stupendous problem fraught with potential eventualities, still, not impossible of satisfactory solution.

When we individually and collectively fail to meet the ideals and demands of the public, we relinquish our right to its trust and confidence. Sordid, commercial ambitions seek to cause us to forfeit the people's confidence. Are we to develop solely as commercialists, worshipping at the shrine of dollar idolatry, the size of our golden calf the index of our attainment and skill? Or shall we continue as true votaries of our science, with the welfare of our fellow-man as our first consideration, with personal reward and independence a co-incident factor of our humanitarian services? We are pressed for the answer.

The world upheaval of but a few years ago is still manifesting itself. We have not accomplished our readjustment. As a profession, in company with all other scientific groups, we have been drawn in the maelstrom of social and commercial confusion. It is little to be wondered that there has been much discussion of various forms of state controlled medicine and cult practices, that seek to bring about a new relationship between physician and patient. Such propaganda is but the bubbling gases escaping from the fermenting process. Effervescent in theory and nature, they may momentarily arrest progress, divert our purpose and cause a feeling of apprehension. We have lost sight of principles. We have been unnecessarily concerned with details.

Compulsory Health Insurance will not and cannot become an American institution. The freedom, temperament and culture of our people will not tolerate it. The domiciliary right of the American home will not countenance the violation of its precincts by the invasion of statute created authority assuming to minister to the flesh and blood of the father and mother, the heads of that home. I have no fear or concern that such a state of affairs will come to pass. My greatest concern lies with the physician, surgeon and specialist of

Corresponding Members

THE following men were elected to corresponding membership in the Radiological Society of North America, at the annual meeting held in Chicago, December 6, 1921:

Dr. R. Gilbert Scott—London Hospital, London, England.

Dr. R. W. A. Salmond—O. B. E., 51 Wellback St., London, W. I.

Professor Wintz—Director Frauen Klinik, Erlangen, Germany.

Professor R. Ledoux-Lebard—23 Rue Casimir-Perier, Paris, 7 e. Arrt.

Professor F. Dessauer—University of Frankfurt, Frankfurt, Germany.

Dr. A. E. Barclay—Kersal, Manchester, England.

Prof. Claud V. Regaud—Director Institute of Radium, Argentiére (Haute Savoie), Paris.

Costa Forssell—Stockholm, Sweden.

These men, because of their position in the field of radiology, will contribute matter of vital interest to our readers. Through them we will be kept in constant and intimate touch with everything of professional interest in their several countries. The Journal considers itself fortunate to have secured contributors of such note.

Gold Medals Awarded

THE constitution of the Radiological Society of North America provides that gold medals shall be awarded to radiologists who have rendered especially valuable service to the profession in a scientific way.

At the annual meeting held in December, gold medals were awarded to Hollis E. Potter, M. D., Augustus W. Crane, M. D., Lewis Gregory Cole, M. D., and H. Kennon Dunham, M. D.

Dr. Potter was given the medal because of his work in devising the movable Bucky Diaphragm, technically known as the Potter-Bucky-Diaphragm. This instrument has proven of inestimable value in cutting off secondary rays from the plate when making exposures through the thick parts of the body.

The work for which Dr. Crane was honored was that done upon diseases of the heart. It will be recalled by many that he devised a method for making tracings of the movements of the different chambers of the heart. These tracings are made by the use of the x-ray and give practically the same information as that gained from the electrocardiograph.

Dr. Lewis Gregory Cole was honored with the gold medal because of his valued work on x-ray diagnosis of the stomach and duodenum. Not only is he a pioneer in the x-ray diagnosis of the diseases of the gastro-intestinal tract

but he has continued to add new material as time goes by. He has been one of the few men in this specialty who has taken the time to check up his x-ray findings at the operating table. This has given him a keen insight into pathology as revealed on the x-ray plate which is equaled by few and excelled by none.

Dr. H. Kennon Dunham was awarded the medal because of his contribution to the knowledge of pulmonary tuberculosis as revealed by the x-ray. He has spent much time in checking up x-ray findings in not only gross pathology as revealed at the postmortem room but has traced these findings as revealed by the microscope and has compared them to the normal histology.

Honor Men

IT is a constitutional provision of the Radiological Society to confer honorary degrees upon men chosen for outstanding work in the field of radiology. These may be physicians, physicists, or others who have distinguished themselves by some work related to the specialty. At the annual meeting held in Chicago, President Williams conferred the honorary degree upon George Edward Pfahler, M. D., William Duane, Ph. D., Professor of Biophysics, Harvard University. Dr. Pfahler was so honored because of his pioneer work in x-ray and radium therapy; Professor Duane, because of valuable work on the measurement of x-ray and the effect of different voltages and filters in the production of short wave length x-rays. It is upon the foundation laid by the physicists that the clinicians build the superstructure of therapeutic and diagnostic results.

Errata

IN the January number of the Journal of Radiology the article entitled, "Homogeneous Radiation of the Chest," by Dr. A. W. Erskine, the following mistakes were made, due to the fact that the author for his own convenience had entered certain notations on the manuscript showing the equivalent centimeters in inches.

Page six, line six, four centimeters should read ten; line fifteen from the bottom, first column, four should read ten. Twelfth line, from the bottom, eight should read twenty; eleventh line, sixteen should read forty; second column, sixteenth line from the bottom, sixteen should read forty; fourteenth line should read twenty-five; bottom line, sixteen should read forty; third column, twentieth line from the bottom, four should read ten; eighth line from the top, six should read fifteen; seventh line from the bottom, four should read ten; fourth line from the bottom, two and one-half should read six; second column, eleventh line from the top, sixteen should read forty.

today and their followers of tomorrow—concern as to how they are going to measure up to the new state of affairs that is to be, how they are going to acquit themselves of their new responsibilities, and concern as to the ideals that they will erect to govern and inspire them. Upon that principle does our future rest. "An age deficient of idealism has ever been one of immorality and superficial attainment, since without the sense of ideas, nobility of character becomes a rare attainment, if possible." (Alcott)

The day of the individual doctor in the light that we have known him, has passed. Group practice of medicine succeeds him, except in certain instances. Community clinical centers must and will be provided. We must, on our own initiative, organize these groups and organizing them demand that our national, state and county medical organizations shall supervise and censor their activities and conduct. A code of ethics was formulated by our elders for their and our guidance. So must we formulate the new ideals that shall govern these groups of medical men. We must revamp, revise and add to that code of ethics so that through its precedents we shall conserve our present distinguished position, acquire renewed public confidence and establish a leadership in state and nation in all matters pertaining to the health and physical welfare of the people. Therein lies our future stability, the future of the medical science, its practice, hopes and aims. While wearing the mantle of science we cannot worship in the temple of gold. The caduceus cannot be cast aside and in its stead the money pots of Midas be accepted as the emblem of the medical profession's integrity.

It is your definite responsibility, as members of a special organization of radiologists, to contribute that constructive support to those whom you delegate as officers of your American Medical Association. A specific task is yours in the accomplishment of the solution of the problem. The degree with which you acquit yourselves in conjunction with your confreres, will determine the future of medicine and the ideal to be sought. Let us ever remember that what is stirring the world's heart, changing the face of the times and representing the form and working of the age is that intelligence, that sentiment, those thoughts and opinions, whose written and spoken word is power. That power is ours, providing we formulate an acceptable ideal that will impregnate the activities of our associates in the readjustment of medical contact with the people who compose our constituency. Frederick C. Warnshuis, M. D., F. A. C. S.

Grand Rapids, Michigan.

**Response delivered at the Annual Banquet of the Radiological Society of North America, Chicago, December 7-8-9, 1921.



Homogeneous Radiation of the Chest

ARTHUR W. ERSKINE, M. D.

Cedar Rapids, Iowa

EVERY ONE who seriously treats cancer of the breast sees cases of recurrent or metastatic carcinoma in which, under x-ray treatment, apparently complete retrogression of the growths takes place and the patient greatly improves in health and strength, but finally dies from a recurrence or an extension of the disease into the mediastinum or the lung.

We know that in these particular patients, at least, a sufficient amount of x-ray causes the disappearance of the superficial growths or at least holds them in check. It is probably also proper to assume that if the mediastinal glands and all parts of the lung were to receive approximately the same dose as the growths immediately underneath the skin, the effect on them would be the same and the progress of the disease as completely stayed in the deep structures as at the surface.

Admitting the correctness of this assumption, and bearing in mind the complexity of the lymphatic drainage of the breast, and the danger of neglecting one chain of glands while concentrating on another, it is evident that uniform radiation of the whole chest is desirable and even essential to the best results. Our problem is, then, to determine what combination of anode-skin distance, size of fields, number of fields, voltage, and filters will produce the most nearly homogeneous radiation, or, more sim-

ply expressed, what set of factors will give the least surface depth dose ratio.

To obtain the average surface-depth distance and the skin area of the chest, about one hundred women were measured by bending a lead wire over the shoulder and around the thorax below the

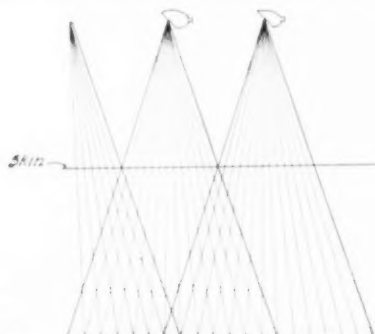


Figure II.—Diagram showing over-exposed erect pyramids of tissue alternating with under-exposed inverted pyramids of tissue when small fields and a short anode-skin distance are used.

nipple line. Composite vertical and transverse sections were constructed from these measurements, (Fig. 1). The average surface depth distance was found to be ten centimeters. A paraffin phantom was then constructed, which, when tested by photographic and ionometric measurements, was shown to have approximately the same absorption value as the living chest.

The size of the fields and the anode-skin distance must be considered together. There is no doubt that by radiating the chest through many small fields it is

possible to administer a full depth dose. In practice, however, the use of many fields has the following disadvantages:

- 1—The center of each field is the base of a pyramid of tissue which receives a progressively smaller percentage of the skin dose as depth increases, (Fig. 2).
- 2—The corner of a field, where it joins the three adjacent fields, is the apex of a pyramid which a short distance under the skin receives almost four times the skin dose, (Fig. 2).
- 3—There is danger of overlapping areas and of leaving untreated strips of surface between areas.

If, for example, instead of treating four areas each ten centimeters square, ten minutes apiece at an anode skin distance of twenty centimeters, the tube be removed to a distance of forty centimeters and the four areas treated for forty minutes, it is evident that the skin dose will be the same. The total amount of radiation received by the body will also be the same. It will, however, be more evenly distributed, and there will be a substantial drop in the surface depth ratio, due to the lessened divergence of the rays at the greater distance. The data of Friedrich and Kroenig, as published by Schmitz, shows that there is a further increase in the depth dose when large fields are used, probably because of increased secondary radiation. My own observations corroborate their findings, as shown in Fig. 3.

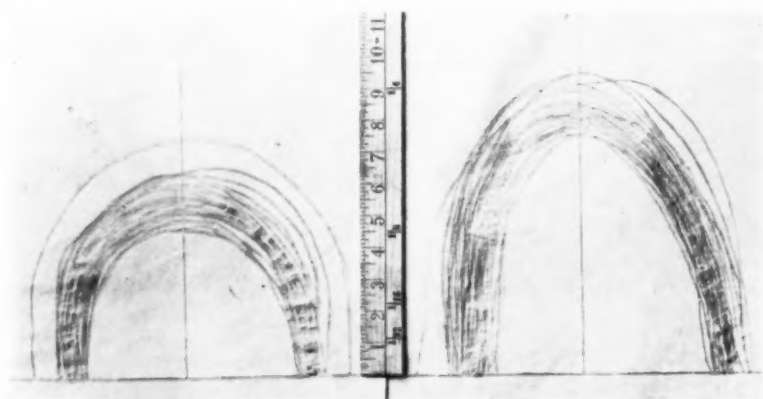


Figure I.—Photograph of composite transverse and vertical sections of one hundred chests.

Size of Area	Seconds to Discharge 10 units at Surface	Seconds to Discharge 10 units at Depth	Quotient
2 CM. Square	17.5	70	4
15 CM. Square	12.5	36	2.9
2 CM. Square	17.5	70	4
15 CM. Square	12.5	38	3

Figure III.—Chart showing surface-depth ratios with small and large areas over the paraffin phantom and over 6 c.m. of water.

100 K. V. Filter of 0.5 m.m. copper and 1.0 m.m. aluminum. Current 2 M.A. Anode-surface distance—40 c.m. Anode-depth distance—50 c.m.

POSITION OF IONIZATION CHAMBER	SECONDS TO DISCHARGE 300/16			
Center of Field	68	68	68	7
Left Edge	7	7	74	7
Right Edge	7	7	72	7
Edge of Anode Side	70	70	74	76
Edge on Cathode Side	72	68	74	72

Figure IV.—Chart showing nearly equal intensity of all parts of the field. 75 K.V., no filter, 12 inch distance.

Measurements with the ionization chamber in different parts of the entire field, when the ordinary type of tube stand is used, show the intensity to be practically the same throughout (Fig. 4).

We may conclude, then, that

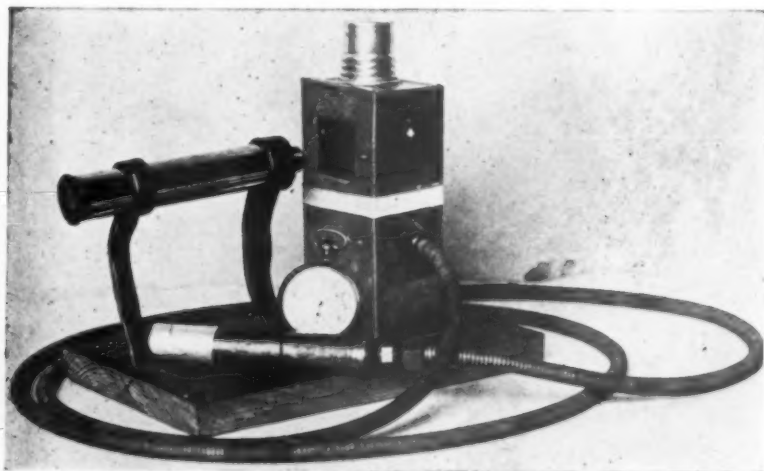


Figure V.—Photograph of measuring apparatus.

the anode-skin distance should be just great enough to permit the entire surface to be treated at one time. Trial shows this distance to be forty centimeters, which will evenly radiate a circle twenty-five centimeters in diameter.

The shape of the half chest, roughly, a quarter of a sphere, lends itself admirably to attack in four directions, antero-posteriorly, postero-anteriorly, laterally, and vertically. To radiate the whole chest it is only necessary to expose two additional areas on the opposite side, one vertically, and one laterally.

Granting that exposure of the half chest in four planes from an anode skin distance of forty centimeters, utilizing the whole field of effective radiation, tends towards uniformity of distribution of the rays without waste of tissue and energy, it is apparent that our problem has become a much simpler one. We have only to determine, if pos-

sible, the combination of voltage and filters that will deliver at least one-fourth of the surface dose to the center of the chest, so that the sum of the four depth doses will equal one skin unit.

In order that relative measurements of intensities might be made rapidly and accurately, we constructed a crude electroscope, equipped with a reading microscope for observing the rate of fall of the gold leaf, and connected to an ionization chamber by an enameled copper wire, which was insulated and supported by paraffin and sulphur, and enclosed in flexible metal tubing. (Fig. 5).

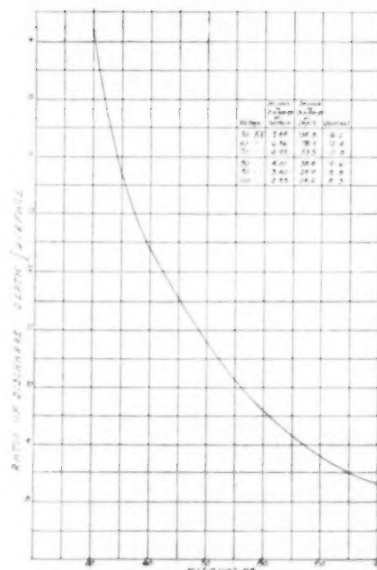


Figure VI.

kilovolts measured with a sphere gap, the ratio was about eight to one. Abandoning the lower voltages as being less efficient, we made a second series of measurements at one hundred kilovolts, using gradually increasing thicknesses of aluminum as filters. The addition of each layer of aluminum was followed by a further drop in the surface-depth ratio, until, with a filter of ten millimeters of aluminum, the necessary ratio of four to one was obtained, (Fig. 7).

The foregoing measurements were all made through a diaphragm two centimeters square in order to eliminate secondary radiation. When the exposures were made over an area fifteen centimeters square, the ratio was reduced to three to one (Fig. 3).

When one-half millimeter of copper backed with a millimeter of aluminum was used in place

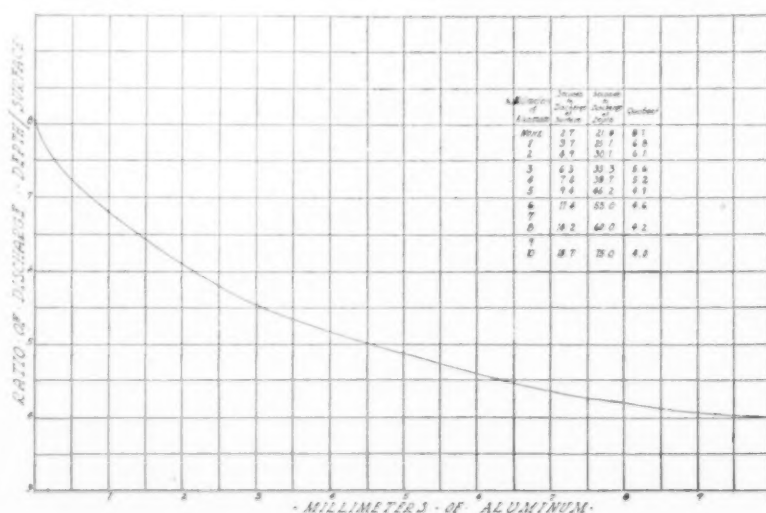


Figure VII.

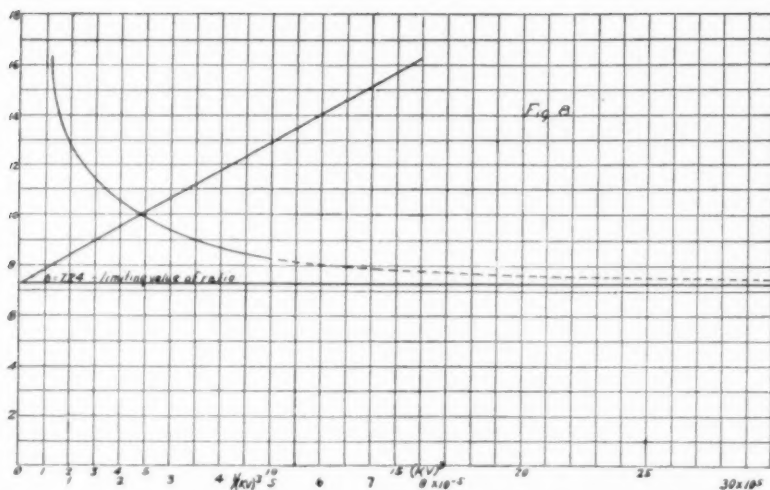


Figure VIII.—The solid portion of the curves in Figures VIII and IX was plotted from the data, the dotted portion was computed. In the case of varying voltage with no filter, the curved line was obtained by plotting the ratio against the cube of the voltage, and the straight line by plotting it against the reciprocal of the cube of the voltage. In Figure IX the curved line was obtained by plotting the ratio against the thickness of the filter, and the straight line by plotting it against the reciprocal of the thickness, minus a constant, which was computed from the equation.

DATA FOR CURVES IN FIG. 8

Seconds to Discharge at Surface	Seconds to Discharge at Depth	Ratio	kv	(kv) ³ × 10 ³	1/(kv) ³ × 10 ⁻⁶
9.44	134.8	16.2	50	125	80
6.36	78.5	12.4	60	216	46
4.95	53.3	10.8	70	343	28
4.00	38.4	9.6	80	512	19
3.40	29.9	8.8	90	729	13
2.93	24.4	8.3	100	1000	10

Computed	7.8	120	1728
	7.6	140	2744
	7.25	200	8000

Distance to Depth—50 cm.

Distance Surface—40 cm.

No filter.

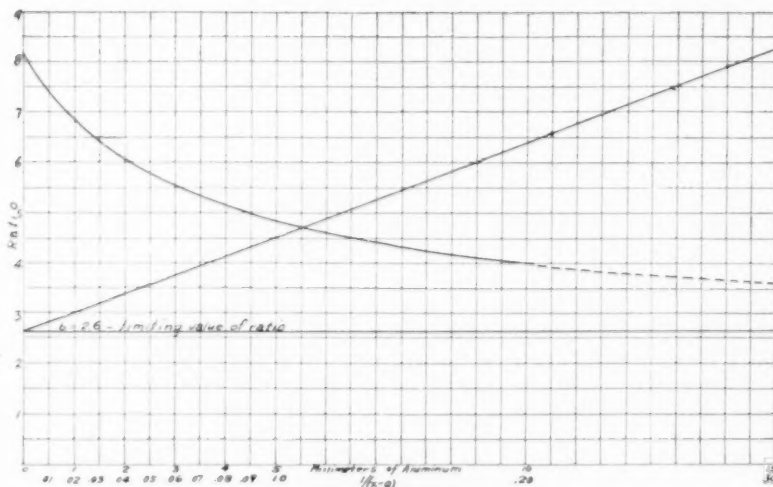
Y=Ratio.

X=KV

(y-b) x³ = K —Equation of Curve

K=1,127,000

b=7.24 —Minimum Value of Ratio.



DATA FOR CURVES IN FIG. 9

Seconds to Discharge at Surface	Seconds to Discharge at Depth	Ratio	Millimeters of Aluminum (x-a)	1/(x-a)	Distance to Depth —50cm.
2.7	21.8	8.1	0	3.45	.29
3.7	25.7	6.8	1	4.45	.225
4.9	30.1	6.1	2	5.45	.184
6.3	35.3	5.6	3	6.45	.155
7.4	38.7	5.2	4	7.45	.135
9.4	46.2	4.9	5	8.45	.118
11.4	53.0	4.6	6	9.45	.106
			7		
14.2	60.0	4.2	8	11.45	.087
			9		
18.7	75.0	4.0	10	13.45	.074

5—The use of these factors will permit nearly homogeneous radiation of the chest.

My thanks are due to Prof. L. B. Loeb of Chicago University, and Prof. L. D. Weld of Coe College, who offered many helpful suggestions as to the construction of the measuring apparatus, and to Mr. Edward M. Smith, whose assistance in taking the readings and arranging the data was invaluable. The curves and data for Fig. 8 and Fig. 9 were furnished by Mr. Ernest E. Smith.

Discussion

DR. W. D. COOLIDGE, Schenectady, N. Y.: Dr. Erskine has referred to the spark-gap tables given in the Standardization Rules of the American Institute of Electrical Engineers, and, in accordance with these tables, has expressed his results in effective volts.

As the major part of the x-ray output of a tube takes place when the voltage is near the maximum, it seems better to give x-ray data in terms of maximum voltage. The transposition is effected by multiplying the effective volts by 1.41.

DR. HENRY SCHMITZ, Chicago: The paper of Dr. Erskine shows exactly what can be done with the application of physical measurement in x-ray therapy, by making such an instrument, which any one can do who

of the filter of ten millimeters of aluminum, there was no material difference in the readings, (Fig. 3).

The rate of discharge of the electroscop with the ionization chamber at a depth of ten centimeters in the paraffin phantom, was the same as when it was placed under six centimeters of water (Fig. 3). This corresponds closely enough to the thickness of the chest walls of the average sized woman of cancer age.

The conclusions to be drawn from this series of observations are:

- 1—The half chest should be treated from four directions, using the whole field of effective radiation.
- 2—The anode-skin distance should be forty centimeters.
- 3—At least one hundred kilovolts should be used.
- 4—The rays should be filtered through ten millimeters of aluminum or one-half millimeter of copper.

knows about the relative intensity of radiation. That is exactly what we want and that is what is claimed by Froelich for his instrument. It also shows us what amount of voltage we have to use and what amount of filter and distance in order to have as favorable a proportion between the surface and the depth dose as we can possibly obtain.

The question of treating cancer of the breast is much easier than the treating of cancer in the body. I feel with our present equipment we will obtain quite favorable results with cancer superficially located. Probably we can treat deeper cancers if we increase the focal distance from sixteen

to twenty-four inches, or even to thirty-two inches. If you do, you need only one field. In treating supra-clavicular lymph nodes you must have even more homogeneous radiation than Dr. Erskine did. Not only that, but the difference between the surface and depth dose will be so small that the depth dose will be almost as intense as the surface dose.

Regarding the question of voltage, we all seem to be at sea. We do not know whether we should use our present machines or not. Last year when I returned from abroad a great many members of the American Radiological Society visited me and asked me if it was necessary to use the high voltage

machine. I said, "No." I wish to repeat the answer I received from Professor Froelich when I asked him whether to do this work it would be necessary to get one of his machines. He laughed and said, "You can use any machine." I can see only one benefit from the high voltage, that is that you can use a higher filtration and save time and obtain a better ratio between surface and depth dose, especially in internal carcinoma. Consequently, the question arises in my mind whether it would not be better to treat a patient with a deep seated carcinoma with a low voltage in one sitting of say six hours instead of a high voltage for one-half hour.

DEPARTMENT of TECHNIQUE

Something New in Deep Therapy Installation

A. F. TYLER, M. D.

Omaha, Neb.

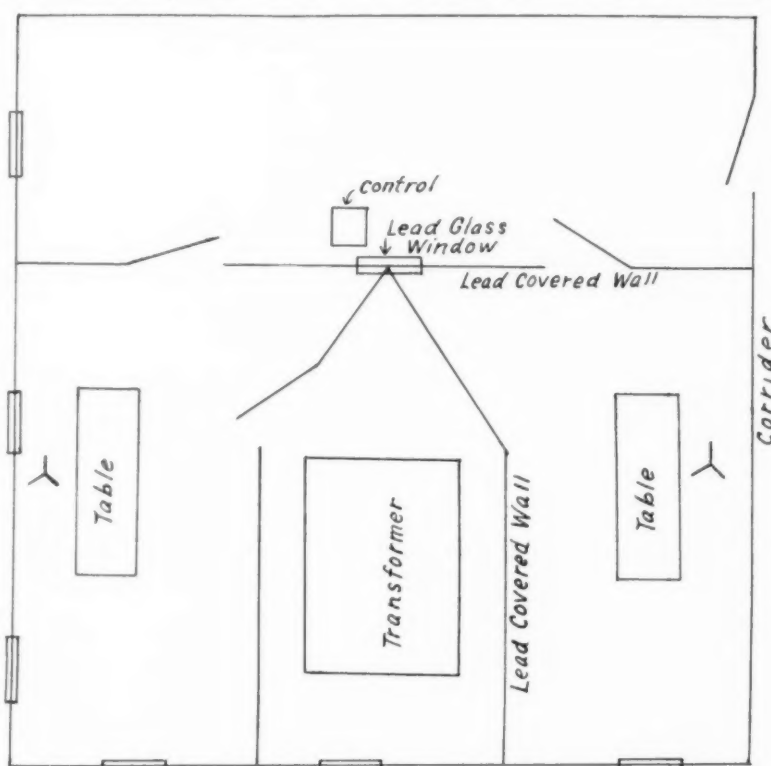
AT this time when many are planning the installation of high powered deep therapy equipment, suggestions from varied sources will not be amiss. The following is the floor plan of my deep therapy department as now operated. This department is in a hospital so that all classes of patients can be treated. Many of those coming to such a department are bedridden.

In addition to the usual complete history and physical examination of each patient presented for deep x-ray therapy, the following laboratory tests are made: urine analysis, complete blood count, blood Wasserman and where possible, microscopical section of the tissue to be treated. The patient is hospitalized while these examinations are being made and is thoroughly alkalinized. The treatment is then given according to technique planned carefully beforehand and based upon the thickness of the part to be treated. Immediately after the treatment is completed, another complete blood count is made and the alkalization is continued.

It will be seen from the illustration that the floor space is twenty-four feet square with an entrance from the corridor near the north side. The room itself is then divided by a lead covered partition extending from east to west, eight feet from the north wall. That portion of the floor south of the partition is then subdivided into two treatment rooms and a transformer room. The transformer room is placed between the two treatment rooms and has the walls brought to a point at the center

of the lead glass window. This arrangement makes it possible for the operator who is north of the lead covered wall to watch both patients and the machine at the same time. Two patients can be treated simultaneously, the high tension leads passing from the trans-

former over the walls of the transformer room which are only six feet high, directly to the tube in each treatment room. The window in the middle of the south wall is fitted with an electrically driven exhaust fan which keeps the air fresh and free from noxious odors.



NEW EQUIPMENT

A Manometer and Flow-Volumeter for Transuterine Peritoneal Inflation to Determine Patency of Fallopian Tubes in Cases of Sterility

A new apparatus devised by Dr. I. C. Rubin for peritoneum work measures the quantity and the flow of oxygen or carbon dioxide gas used in insufflating the uterus to test the Fallopian tubes for patency. A manometer of the "tycos" or mercury type is combined with it, allowing for pressure reading at the same time as the gas flows. It does away with the necessity of first displac-

ing water from another vessel at a certain rate of flow to estimate the volume of gas. This at best was only an approximate estimation.

In this apparatus the pulsating type of water displacement meter is used. It is adapted from the well-known chlorine control apparatus employed by the firm of Wallace & Tier-

nan for water purification by the process of chlorination. The meter is of glass and is therefore non-corrodible and consists of an inverted glass siphon within a cylindrical glass meter. The latter is calibrated to a given capacity, as a rule 40 cc. It is hydraulic in principle, scientific, accurate and dependable. The upper end of the glass cylinder is attenuated to a narrow tube to which rubber tubing is attached to convey the gas from its

NEW EQUIPMENT

source. The lower end dips down into the water contained in the large glass tube or jar of convenient size. This glass tube or jar is provided with a rubber stopper perforated at three points, through one of which the narrow end of the volumeter passes. Two separate glass tubes pass each into the container to just below the lower limit of the stopper. To one of these the pressure gauge is attached and to the other a piece of rubber tubing for the outlet of the gas. To this piece of rubber tubing the intra-uterine cannula is attached. A spring relief valve may be provided which works automatically, or in lieu of this a needle valve is placed in the course of the outlet tubing. This latter is found effective and easy to handle. The spring valve is regulated to blow off at a pressure of 250 millimeters of mercury. While this can be dispensed with it is an aid and is well combined with the needle valve relief. For the convenience of those who do not care to take the trouble of doing this a siphon meter and glass jar with outlet and inlet connections blown in one piece and attached to a mercurial manometer, can be obtained.

The operation of the siphon meter is as follows: View X shows the water level 2 in the meter at the beginning of the pulsation and view Y shows the water level 2 just before the siphon C-G breaks at D, which completes one pulsation of the meter. When the downward flowing gas in A reaches the point D, it will rush up through the tube G of the syphon, and the bell or compartment B will refill with water up to the upper end of C. This completes one pulsation or measure of the meter, and the amount of gas delivered by this one pulsation is, of course, the capacity of the compartment B between the points F and D. The siphon meter used has a capacity of 40 cc. The amount of gas flowing may be determined by counting

the number of pulsations of the meter per minute.

For the purpose of determining the patency of the Fallopian tubes four pulsations delivering 160 cc. of gas are all that are required. In thin individuals from two to three pulsations will suffice to produce in the patent cases the subphrenic pneumoperitoneum which will be clearly seen with the fluoroscope. The pressure reading is of considerable importance, and the rate of flow is best regulated previous to a rise of 100 millimeters within 15 seconds. This can be determined readily by pinching the outlet tubing as the flow is regulated till it causes a rise of pressure to 100 mm. mercury in 15 seconds time. A ratio of 10 seconds to 100 mm. will also be satisfactory, but in the non-patent Fallopian tubes, where the matter of pressure is of somewhat greater importance than in the case of patency, it is better to have a slower rate of flow, i. e., the 15 seconds to 100 mm. mercury.

With this rate established (and this is done in a few seconds) the gas is allowed to pass through the volumeter and thence through the outlet tubing and cannula into the uterus. The needle valve is released until the cannula is inserted well into the uterine cavity beyond the internal os when it should be shut, making the system air-tight. Almost instantly the pressure rises at the rate pre-determined and will vary somewhat in cases of patency. The pressure required to overcome the resistance of the uterus and tubes where there is no tubal obstruction to the free passage of the gas will vary between 40 and 100 mm. When reaching these points it will fall sharply or slowly or even fluctuate about them. Occasionally the initial rise of pressure in the patent tubes will be higher, reaching 160 before it drops. The significance of this will be taken up in another communication.

In the non-patent tubes the pressure rises steadily to a point well beyond 200. It is

not necessary to carry this beyond 250 mm. because in all the cases so far examined this pressure was found to indicate occlusion. When, as occasionally happens, the gas will go through after reaching a pressure of 200 mm. in 15 seconds. Dr. Rubin has used a slower rate of flow in many cases, particularly in the non-patent cases where it is desirable to check up the finding of the first examination. This can be done during the same sitting when the flow is retarded, so that it requires 20 to 30 seconds to raise the mercury column to 100 millimeters.

While the apparatus has been assembled for the transuterine peritoneal inflation to determine the patency of Fallopian tubes in cases of sterility, it may be used to advantage in the direct transperitoneal inflation by abdominal puncture. The pressure gauge is in the latter case not so important but it provides an accurate volumetric measure of the gas introduced into the peritoneal cavity. The flow being visible through the volumeter, it may be stopped at any point when a desired amount has been given. The number of pulsations would have to be increased to say, 12 times 40 cc. or 25 times 40 cc. depending upon the amount of gas that one desires to introduce into the peritoneal cavity.

Journal of Radiology

—21

Thus far the apparatus has been used in 225 cases out of a total of 350 insufflations and has given complete satisfaction.

Dr. Reuben Peterson collaborated with Dr. Rubin and offered many valuable suggestions in developing the finer details of the technique and in checking up the work. To him came the happy thought of combining the transuterine with the transperitoneal methods of producing artificial pneumoperitoneum, and in his hands the method has become established as a valuable adjunct in gynecological diagnosis.



ABSTRACTS *and* REVIEWS

The Campaign Against Cancer. By Francis Carter Wood, M. D., Director of Crocker Institute for Cancer Research. *Journal of Cancer Research*, September, 1921, p. 261.

FOUR things have led to the present public interest in cancer; increase in recorded frequency; dissatisfaction among surgeons with the results of operative treatment, effects of the publicity campaign against tuberculosis, and widespread propaganda concerning radium and roentgen rays in treatment.

Progress is now being made under three heads: publicity, experimental investigation, and improvement in methods of treating.

The Society for the Control of Cancer is one of the foremost agents in the publicity campaign having committees in all the states and larger cities to help in the work of educating the public and fighting the quack.

Animal experimentation on white mice and rats has proved the following: that massage spreads the lesion, that cutting a piece out for microscopical examination does not necessarily spread the disease. The exact amount of radium necessary to kill a cancer cell in a given length of time has also been determined. It has been shown that neither x-rays nor radium can kill all cancer.

What the future development of radiation therapy will be is not possible to prophesy. The author thinks lympho-sarcoma, basal cell tumors of the skin of the face, and carcinoma of the cervix may ultimately be transferred to the radiotherapist and possibly a ten per cent permanent cure may be expected.

The claim that fifty per cent of carcinoma of the cervix can be cured without distress is not to be accepted.

He advises prompt surgery in all operable metastasizing tumors and radium and x-ray for palliation in inoperable cases.

X-ray Dermatitis. By Mary L. H. Arnold Snow, M. D., New York City. *Medical Record*, Nov. 26th, 1921, p. 927.

DERMATITIS or sequelae conditions may result from treatment in any practice where the x-ray is operated by a novice or one unskilled or careless in technique. Factors in the production of undesired effects are: lack of adequate protective apparatus or filters, the strength of the rays including their cumulative effect, the proximity of the tube, the duration of the treatment, including repetitions, the patient's susceptibility and idiosyncrasy. Scattered or vagrant radiation must not be ignored as it is of the same penetration as the original beam.

Wetherbee warns against the "overlapping of the areas exposed" and, to avoid burns from a patient going from one laboratory to another, advises the use of an x-ray chart which includes a record of spark gap, milliamperage, time, distance, number of exposures, date of last exposure, and patient's position. The time for erythema to appear—ten to fourteen days—and to disappear, about two to six weeks, must be kept in mind.

The rays have a cumulative effect. Dermatitis may follow a single exposure with improper technique, or it may follow a number of moderately heavy exposures covering too long a period of time. It is apt to follow one or a few heavy exposures. If raying is combined with fluoroscopy dermatitis may follow too long exposures. In radiatherapeutic practice it is apt to follow fractional doses covering weeks and even months or follow-

ing too heavy doses repeated at too short intervals. Dermatitis has been reported as occurring from fifteen minutes to nine months after treatment. These extreme cases were accompanied by ulcerations.

Cases that have been exposed to artificial freezing, fulguration, or any process lessening the vitality of the part call for precaution.

Thirteen to fifteen inches from the target is the minimum distance for safety.

The idiosyncrasy of the patient must be taken into account, opinions to the contrary notwithstanding.

Registrable x-ray evidence of pathology invading the human body will be manifested as a variant from the normal.

An x-ray dermatitis is similar to any other when beginning and is apt to pass unnoticed by the novice. It is well to ask the patient to notify you of any erythema appearing upon bathing as it is more apt to be noticeable then. A slight itching is usually the first symptom noticed by the patient. Freckling or tanning may be symptoms. Dermatitis may be acute or chronic.

Beck describes the condition as having three degrees—"The first is characterized by hyperemia, infiltration, increased temperature, exfoliation in small scales . . . with itching. The main feature of the second degree consists in the formation of blisters . . . the third and gravest degree is characterized by the escharotic destruction of irradiated tissues. They show the signs of dry gangrene and appear brownish black . . . a granulating ulcer remains, the cicatrization of which may take months."

Freckling may last a long time, likewise tanning, though it may disappear in a few weeks. Hair regenerates in from four to twelve weeks, nails in the course of a few months. The latter react to the rays very quickly. (A second paper is to follow.)

The Treatment of Advanced Carcinoma of the Uterus by Radium. By Arthur Burrows, M. D., London. *Brit. M. J.*, Oct. 1, 1921, p. 524.

THE author takes up the treatment of advanced uterine carcinoma only.

One of two methods, neither of which so far seems better than the other, is used by him. There is no necessity for the heavy metal screening that has been employed. In no case need a screen thicker than one millimeter of silver be employed, unless in the administration of huge doses such as are used at Johns Hopkins.

In the screened method about seven tubes are inserted under anesthetic. A large one of about fifty millicuries of emanation (about fifty milligrams of radium element) screened by one milligram of silver is introduced well up into the cervical canal. Six other smaller tubes, screened by three-tenths mm. of brass are pushed into or about the cervical growth. The strength of each of these is about fifteen millicuries. A dose never less than one hundred and twenty millicuries must be given for twenty-four hours.

In the unscreened method the large central tube as above is used but small unscreened capillary glass tubes, each containing radium emanation of a strength of two to five, and sometimes seven, millicuries, are inserted in the surrounding tissues. The large tube is removed after twenty-four hours but the smaller ones are left in.

With strict cleanliness there is no danger in either method. Douching is performed,

daily after the operation to keep the reacting growth clean and to prevent adhesions.

There appears to be considerable possible variation in the quantity of radium employed, time of application, and screening used.

Some extremely advanced cases must be left alone and the outlook is not good in cases where the growth is very large and hard, or where there is an infiltrating growth in the vaginal wall. Cases just beyond operability are the most hopeful.

The patient in a "symptomatic cure" should feel perfectly well and be free from pain and discharge. The uterus should be quite mobile, the cervix small and smooth, and any scar tissue should be soft and supple.

Of a hundred cases treated between April, 1916 and July, 1918 the results are tabulated as follows: six are still definitely well; five were well one year after treatment but could not be traced after that; seven were well three to six months after treatment and have not returned; six were rendered operable; thirty-two were rendered comfortable and able to work from six months to two years, though some of these have since died; twenty-six were either not improved or died quickly; sixteen could not be traced for any length of time; two were given prophylactic irradiation.

Apart from all facts given above radiation treatment for palliation alone would be well worth while.

Pre-Operative and Post-Operative Radium Therapy: Report of Cases, Dosage and Methods. By Ben R. Kirkendall, M. D., Columbus, Ohio. *The Ohio State M. J.*, Dec., 1921, p. 837.

DR. Kirkendall's experience with eight hundred and seventeen cases, during a four year period, covering cancer of the mouth, rectum, cervix, uterus and adnexa, also cancer of the bladder, kidney, prostate, ovary, vagina and the colon is here recounted.

Fifty-three of these had cancer of the mouth, treated after surgery. Thirty are still living, six of whom are unimproved, twenty-seven improved for periods varying from three months to a year. Nineteen were free from disease for a period varying from six months to three and one-half years. One could not be traced.

Twenty-two were treated for cancer of the rectum. Six of these were post-operative cases. Three were not improved, one has been free from disease for a year, one for nine months and nine are still living. Colostomy first seemed to bring better results.

There were fifty-six cases of cancer of the cervix, twenty-nine were operated on before radium treatment. Forty-two are still living, thirty have been free from disease for periods varying from six months to four years.

One hundred and twenty-four cases of cancer of the uterus were treated. Sixty-five were post-operative cases, that is radium had been used directly after operation and in twenty others operation had preceded treatment some little time. Fifty-nine are still living but this is not given as a final report for some have been treated only quite recently. The use of the cautery before treatment is advocated by the author.

Of the other pathology treated the best results were secured with cancer of the prostate (nineteen cases, seven post-operative) and in cancer of the colon of which three cases, all post-operative were treated. A report on cancer of the breast will be given this year before the American Radium Society.

The dosage for cancer of the cervix and uterus is practically the same. Within a week's time three applications of radium into the cervix are given, fifty to one hundred milligrams of radium at one time are used with eight-tenths mm. of brass screening and black rubber covering for a total dosage of 3500 or 3600 milligram hours. The application is made over night every other day, preceded by a soap suds enema and the bladder kept empty with a catheter.

Cancer of the rectum is given from one to two twelve hour doses, with fifty milligrams of radium in a brass screen with several layers of gauze and rubber around it. One twelve hour treatment in a month's time is given again if necessary.

In cancer of the ovary, or in a case of abdominal metastasis, a heavy black rubber tube with a closed end and perforated side is inserted into or around the growth, and fifty to a hundred milligrams of unscreened radium on wires is lowered into this tube for direct application. A dose of from four to eight and even twelve hours duration has been given with impunity. If the growths are extensive the radium is moved to a new location by shortening the wires and bending the ends over the rubber tube to hold them.

In cancer of the bladder and prostate when there has been a supra-pubic drainage performed unscreened radium is lowered into the bladder to the growth and left from six to eight hours.

In cancer of the mouth radium screened with brass is used, or is used unscreened except for rubber. Fifty to a hundred milligrams of radium given six to eight hours are given according to the lesion.

All sarcoma cases are treated with radium needles or with the implantation of radium tubes. Over forty sarcomata have been treated by the author but the time limit did not permit a report of these in this paper.

The following conclusions are drawn:

1. Cases of carcinoma of the vagina and prostate are best treated with radium alone.
2. Cases of cancer of the cervix and uterus which have responded well to the treatment should rarely be hysterectomized later, as distant quiescent disease cells may be stimulated to recurrence.
3. Radium can be used before surgery to make non-surgical cases surgical.
4. Radium after surgery may make a success of the operation.
5. Its use in recurrences is palliative but it may cure also.

A Histological Study of the Effects of Radium on Carcinoma of the Cervix. By Charles C. Norris, M. D., and Norman S. Rothschild, M. D., Philadelphia, Pa. *Am. J. Roentgenology*, Oct., 1921, p. 604.

THE clinical and pathological classifications are first considered. The condition has three stages: a hard nodule in the substance of the cervical lip; a circumscribed, indurated ulcer of the portico or cervical canal, and a non-diffuse low papillary outgrowth covering a portion of the lip or canal. Other classifications are: induration with loss of tissue; disintegration, and excavation. Still another is divided into advanced, borderline, and early.

Pathologically, two types are found: the squamous cell carcinoma of two varieties, the basal cell and prickly cell, and the adenocarcinoma.

Many factors are concerned in the effectiveness of radium on malignant growth. Some cells may be radio-receptive, others radio-refractory. During mitosis the cell is more sensitive than in the resting stage. Immature, undifferentiated and embryonal cells possess a great affinity for radium while mature cells and tissue have but slight affinity. The for-

mer cells are destroyed by a dose that would produce but little change in mature cells.

Bergonis and Tirbondeau believe cells vary in their reaction according as they are fixed or not in their morphology and function; for example, a neuroma is much more sensitive than a normal nerve, spermatozoa are much less sensitive than the cellular layer they are developed from and all highly specialized cells have a low radio-sensibility.

In normal tissue a slight exposure acts as a stimulant to the tissue producing congestion which is followed by increased formation of fibrous tissue. If the exposure is prolonged or the infiltration is insufficient the action is caustic and an acute inflammation results, which may even go on to necrosis and sloughing of tissue. If the exposure has been accurately calculated the inflammation will slowly subside and the deeper tissues will participate in a diminishing ratio according to their depth. In all there is an inflammatory condition with a leucocytic migration and an invasion of small round cells. Fibrous tissue formation is the next stage and the newly formed tissue with its capillary blood vessels may surround individual cells or areas of cells. By subsequent contraction of connective tissue the blood supply to these tissues is diminished. If rapid occlusion takes place necrosis will follow quickly, but if more gradual, atrophic changes may follow.

There are five stages in the histological effects upon malignant tissue, these are: the stage of acute inflammatory reaction lasting one week; stage of early nuclear and cytoplasmic changes, in which mitosis often ceases, lasting likewise a week; stage of intercellular changes in which infiltration of the malignant cells by young fibroblasts takes place; the stage of destruction starting with the fourth week and continuing to the ninth. In this stage the nuclei of the malignant cells may be broken up into chromatin masses or may shrink and cytolysis takes place. The cancer cells show numerical reduction and the fibrous overgrowth is conspicuous. In the fifth and last stage the cancer cells appear as compressed bands in the fibrous stroma and only the small contracted nuclei remain. At a later period no trace remains of the malignant cells. There is, of course, a blending of these stages.

Finzi believes the production of the connective tissue is the essential feature in the death of the malignant cells. Frank believes the rays cause the connective tissue to contract, with obliteration of the vessels and lymphatics and starvation of the malignant cells.

Several others have observed cellular changes preceding the fibroblastic injection. The author believes the effect of the rays caused cessation of mitosis, destruction of nuclei, cytolysis, and ultimate destruction of the cells.

Extra Bones in the Wrist and Ankle Found by Roentgen Rays. By A. Howard Pirie, M. D., Montreal, Canada. *The American Journal of Roentgenology*, Oct., 1921, p. 569.

CERTAIN extra bones in the wrist are frequent, others moderately frequent and still others very rare.

In the foot the os trigonum, the tibiale externum, secondary os calcis, os peroneum, and one other without a name are fairly common.

In the hand the os centrale and the os triangulare are moderately rare.

Often in case of fracture this knowledge is of value in avoiding mistakes and often it has a medico-legal interest.

Some of these extra bones are explained by comparative anatomy but a more general explanation is the one founded on the embryology of the bones. Fusion sometimes does

not take place and an extra bone is thus formed. Sometimes however these extra bones will be found fused to other bones. An extra long styloid of the ulna is caused often by the fusion of the os triangulare to the tip of the styloid.

Sesamoid bones are in the same class as extra bones, have no function and are where they are in order to get them out of the way.

There are about twenty extra bones found in the wrist. The last edition of Quain's *Anatomy* gives the full list. The author has had experience with six of these.

One illustration shows the os magnum with a projection on it which represents the os centrale fused to the former bone. This bone is found constant in monkeys as one of the bones of the wrist.

The os triangulare is found in sixty-five per cent of second month embryos but is rare in the adult. It is a perfectly formed little bone like a sesamoid and can be confused with a fractured styloid which will have a rough edge, though this rough edge may have disappeared in an old fracture and the styloid be deformed.

If an extra bone is suspected an examination of both wrists should be made for the extra bone will usually appear in the other wrist also.

The ulnare externum is a rare bone. One illustration of it is given lying between the fifth metacarpel, the unciform and the cuneiform.

The radiale externum is the end of the tubercle of the scaphoid, is quite general in mammals except man.

The appearance of the scaphoid in roentgenograms is more varied than any other bone of the wrist. Diagnosis of divided scaphoid is justified if it is found divided in both wrists. Usually when it appears divided it will be found that it is due to a fracture.

Thickenings inside of normal bones may give the appearance of extra bones but stereoscopic examination will usually make this clear.

In the foot the os trigonum is shown in seven to eight per cent of roentgenograms of the ankle. It is in reality the posterior external tubercle of the astragalus. It may be short and stout or long and slender.

The secondary os calcis is a small bone found in the angle between the os calcis, the astragalus and the scaphoid. It corresponds to the os centrale in the hand.

The tibiale externum is found at the tubercosity of the scaphoid. It is a constant bone in many animals and is found in the second month human embryo. Surgeons should be familiar with it as it gives the appearance of a fracture. It usually occurs on both sides and is commoner in women than in men.

The os peroneum is a common bone lying in the tendon of the peroneus longus, usually it is seen in the semilateral view between the os calcis and the scaphoid.

The os vesalianum is a very rare bone at the base of the fifth metacarpel and must be distinguished from a fracture. It was discovered nearly three hundred years ago.

The last bone described is nameless. It is not infrequently found at the posterior and upper part of the navicular. In one case it appeared fused with the scaphoid and in one with the astragalus. The author consulted the professor of anatomy in Edinburgh University who said he had never seen nor heard of this bone but afterwards reported its discovery in the dissecting room.

The author had special opportunities of examining roentgenograms during the war and so made a large collection of these cases.

Extra bones are best distinguished from fractures by comparing the bones of the opposite wrist or ankle.

Illustrations of all bones described in this article are given in the original publication.

ABSTRACTS AND REVIEWS

Primary Sarcoma of the Vertebrae. By Karl F. Kesmodel, M. D., Walter Reed Hospital, Washington, D. C., American J. of Roentgenology, Oct., 1921, p. 573.

PPRIMARY sarcoma of the vertebrae is uncommon. Its detection is difficult, often missed, and often misinterpreted as tuberculosis of the spine. The presence of tuberculosis in the family should not legislate against the diagnosis of sarcoma as shown by two cases in the author's experience.

Neither must age be given undue consideration as sarcoma has been found from the age of one year to seventy.

History of trauma frequently is present. Pain is a prominent symptom. Anesthesia and paresthesia are noted. The sensation of touch and thermal changes may be absent in certain areas. Often there is a difference between the reflexes of the two sides. Oppenheim, clonus, and Romberg may be obtained. There is muscular weakness with ataxia and atrophy.

Positive Roentgenographic findings may be absent. No observable change in the outline or structure may be present, or if present not by any means characteristic. These changes are easily confused with those of tuberculosis. Owing to the irregularity of the destruction there is but little deformity in the vertical axis of the spinal column. Abscess formation is absent but invasion of the surrounding soft tissues may stimulate an abscess.

Sarcoma of the vertebrae must be differentiated from tuberculosis of the spine, spinal cord tumors, metastatic malignancy, fractures, syphilis, and typhoid. Tuberculosis attacks the joint early, destroying the intervertebral disc, whereas in sarcoma the body is first attacked, and the intervertebral space is affected but little. The abscess common in tuberculosis is absent in sarcoma.

Differentiation from primary tumors of the cord rests almost entirely upon radiographic findings. In sarcoma the lesion is primarily of the destructive type, in primary tumor the changes are due to pressure and the slow growing type will give a fusiform widening of the neural canal while the rapidly growing type will give a distinct widening in a specific region with some erosion of the inner margins where the tumor passes out of the canal.

In metastatic malignancy the lesion is multiple and the primary lesion can usually be demonstrated. The location of metastasis in the individual vertebra is central, whereas the primary tumor usually appears at the margin.

In fractures there is usually a history of severe trauma, the deformity is of the compression type and there is no evidence of bone destruction. Should a fracture occur at the site of the tumor, the true lesion may be missed altogether.

Syphilis and typhoid of the spine can usually be ruled out by history and laboratory tests. The process in these cases will often be accompanied by proliferative changes, bridging or actual ankylosis and other evidence of repair which will be absent in neoplasm.

Histories of four cases with illustrations are given. These were all proved at operation.

The author draws the conclusion that primary sarcoma of the vertebrae is not a common lesion and that when it does occur it is very easily confused with Pott's Disease. It may or may not give roentgenographic evidence of its presence. Repeated roentgenographic examinations showing rapid destruction of the bone with little involvement of the intervertebral discs are necessary for true diagnosis.

Squamous Cell Carcinoma of the Antrum.

Report of a Case Treated With Radium Alone and Free From Recurrence Twenty-two Months After the Last Application. By J. Harper Blaisdell, M. D., Boston. Boston M. & S. J., Nov. 10, 1921, p. 570.

THE author calls attention to the Mayo Clinic having abandoned the removal of

the upper jaw in favor of a method combining the cautery and radium. The inside of the antrum comes away as a sequestrum in about two months time after the use of the cautery.

The case treated by the author with radium alone was squamous cell carcinoma of the left antrum developing after a moderately painful alveolar abscess which followed in the wake of a gauze dressing left in a tooth socket after extraction. Decaying snags and pyorrhea had preceded the extraction at which time a pledget of cotton had been found at the end of the root canal.

The patient's cheek was badly swollen, the growth was large enough to push the nose over to one side considerably. The shape of the palate was not altered. There was obstruction of the nostril on the affected side and discharge from it.

Fifty milligrams of radium element, screened with 0.5 millimeters of silver and one millimeter of brass was introduced by way of an incision made through the canine fossa. This was left in place for twenty-four hours.

Slight reaction to the radium and relief of swelling, pain and tenderness were the immediate symptoms. Thirty-two days later fifty milligrams of radium were introduced.

Three weeks after this treatment the patient's sufferings began to be extreme. Loss of teeth, sloughing of the hard palate and the alveolar processes took place. The patient's mental processes were dulled markedly, his loss in weight was fifty pounds. During the last month of this three month period he was confined to bed and his death deemed inevitable. Finally a large mass of sequestrum came away and from that time on improvement was very rapid.

Complete removal of the antrum and its surrounding structures was made, the normal tissue healed rapidly and the patient was back at work in a few weeks. Twenty-two months after the second treatment he is vigorous as ever. There is a thickness of speech and some difficulty in eating but for the present he declines any help for this.

Some Criteria of X-ray Diagnosis. By Frederick W. O'Brien, M. D., Boston. Boston M. & S. J., Nov. 17, 1921, p. 591.

THE criticism made of x-ray diagnosis by certain eminent men is partly due to the following causes: the commercial development of a certain type of x-ray apparatus; lack of appreciation of certain criteria in x-ray diagnosis; faulty methods; failure of consultant and roentgenologist to cooperate; and a misapprehension of the limitations of x-ray in relation to final diagnosis.

The development in apparatus is compared to that in surgical instruments. Just as the electric trephine is a boon, when directed by competent hands, so is the small transformer; but in the wrong hands dangers far exceeding those accompanying old methods accompany each.

Any layman may learn to make good x-ray negatives by rule of thumb but the technician lacks the medical training and intuition to accomplish what the roentgenologist can. And the physician's interpretative work is of limited value until he has had special training in roentgenology. In spite of these facts some recognized hospitals employ laymen to do not only technical but interpretative work. The technician has a place but should never be allowed to work without the direct supervision of the thoroughly trained and experienced roentgenologist.

As to method employed in diagnosis the competent roentgenologist knows that there are limitations to both fluoroscopic and photographic methods and works accordingly. The roentgenoscope is applicable to areas showing

gross pathological changes but this method should not be used for lung and gastro-intestinal diagnosis regardless of its limitations.

Interchange of opinion with clinician, surgeon, or specialist is essential to well-rounded diagnosis.

Preparation of the patient is important and sometimes grossly neglected. The presence of food in the gastro-intestinal tract has been known to lead to very mistaken diagnosis.

Making one plate only is often worse than making none at all.

True economy for the patient will often consist in letting the roentgenologist choose his own method of examination.

When it comes to teeth the response of a tooth to the vitality test absolves it whatever roentgenographic appearances may say. Abscess cavities may be mistaken for pus sacs. Increased radiability does not always mean necrosis.

In lung disease, generally speaking, clinical as well as x-ray evidence must contribute to reliable diagnosis. Negative diagnosis is comparatively easy here but reliable positive diagnosis requires more care.

In some cases ruling out other possible pathology is a valuable aid to the clinician and should not be dispensed with, e. g., a suspected case of early, acute osteomyelitis.

In all diagnosis the author much prefers the term "no pathology recognized" to that of "negative." A "negative diagnosis" of gallstones, resulting from routine examination, is almost worthless.

Perspective with proper alignment, not smashing the camera is the author's avowed aim. X-rays should be employed universally and the diagnosis is proportional in value to the roentgenologist making it.

Important Points in Bone Surgery. By Joseph W. Walsh, M. D., Brooklyn, N. Y. New York Medical Journal, Nov. 16, 1921, p. 576.

NO branch of surgery is more difficult of performance than that of the bones and joints.

X-ray surgical diagnosis in structural bone diseases is an important aid to the surgeon as a guide before operation and a mentor after operation. The x-ray enables surgeons to see that end results of the closed method of treating fractures are often not all that could be desired; overlapping and shortening in the long bones often exist, poor alignment and angulation near the point of union occur, with consequent weakness and awkwardness in walking, resulting often in fractures of bones of the lower extremities.

Bone tumors are chiefly: exostoses, chondromata, fibromata, sarcomata, carcinomata and cystic tumors. Early radical operation is advised for all except exostoses.

The use of radium in malignant bone conditions has been advised, using a considerable amount of radium in lead tubes one-tenth to two mm. in thickness, in much the same way that MacDonald* used it for deep growths. He used two hundred and fifty mg. of bromide of radium in platinum tubes two and a half mm. thick, keeping the tube in the tumor and leaving it in place for forty-eight hours. A long application like this is not advised more often than every six weeks. The use of radium in any case should be after experience in its application and careful study.

One object of this article is to induce a greater appreciation of the value of the x-ray and its more frequent use in the treatment of fractures in their early stages, the stage of absorption before the formation of plastic lymph, when so many poorly reduced fractures can be brought to a position of proper reduction and apposition.

*MacDonald, British Medical Journal, Dec. 9, 1911.

ABSTRACTS AND REVIEWS

Radium in Surgery. By W. S. Schley, M. D., New York City. New York Medical Journal, Nov. 16, 1921, p. 573.

RADIUM is applicable in surgery where used as an adjuvant measure. In some cases it can better accomplish a cure but there are regions where surgery, experience has shown, is better. Reference here is to epitheliomata where the lesion involves the periosteum and bone.

In the capillary nevus radium has an exceedingly good effect. Brilliant results have been secured in the larger hemangiomata. Keloid yields remarkable results if care is used. Warts, keratoses, intractable eczema, and psoriasis have been successfully treated.

Inoperable carcinomata of the mouth, tongue, and pharynx, esophageal malignancy, rectal carcinoma, and carcinoma of the bladder and prostate can all be retarded by the use of radium. There have been some cures reported in all of these but cases of the stomach, liver and intestines can be only retarded by treatment. Improper treatment makes them worse of course.

Carcinoma of the urethra and contiguous part of the bladder has shown retrogression in a case under the author's care. Inoperable cancer of the uterus has been wonderfully benefited if not cured, but carcinoma of the vagina the author believes is not benefited. Many fibroid uteri react astonishingly.

Enlarged spleen has been treated with satisfying results.

Enlarged thymus in infancy and childhood and lymphosarcoma of the glandular system and mediastinum have been very successfully treated.

In operable breast cases and where operation is refused treatment produces very favorable systemic results.

Much harm has been done and discredit brought upon radium treatment by improper dosage. Under treatment as well as over treatment can produce harmful results. Radium has been used in cases that should have gone to the surgeon and the surgeon has operated cases that should have had radium and not surgery. At times radium should be used in preparation for surgery.

Its postoperative value is not to be gained. In failures the technic has probably been at fault.

In the use of radium therapeutically the first considerations must be: the different reactions in different tissues; different skin quality and texture for both superficial and deep application; length of exposure; quantity of radium salt or emanation and kind and quantity of filtration or screening; character of growth and location; form of treatment surface or implantation and from what direction; also whether to use massive doses or small and oft repeated doses.

Radium is in its infancy, not its old age. Surgery has been outdone in many instances. A closer relation should exist between all workers.

Biological Determination of Radiation Dosage. By Francis Carter Wood, M. D., New York City. J. Radiol. Feb., 1922.

TO secure permanent results in the treatment of deep seated neoplasms with highly filtered rays much larger doses than previously used must be given. The dose which the skin receives must be terminated just at the point at which a slight erythema appears, or as some claim, just a little in excess of this. These statements are true no matter what type of machine is employed and no matter what voltage is employed.

Burns produced without a filter or with a low degree of filtration are not more severe than those produced by one using a thick copper filter and the highest voltage obtainable. With the former four or five erythema doses can be given in a few minutes while with the later hours are required to exceed

the proper limit of skin exposure although deeper burns will result from it.

Determination of dosage is of the first importance. Insufficient raying will stimulate instead of retarding tumor growth while too much raying may cause serious, even fatal injuries to the internal tissues and organs.

Previous methods of determination of dosage, when heavy filters of any metal are employed, are unreliable. A convenient and accurate method of determining the skin dose and the amount reaching the tissues much deeper down is the present need.

Present scientific knowledge makes possible the construction of an ionization chamber of such dimensions that it can be placed in contact with the tumor, if cervical, rectal, or prostatic, or under the patient if an abdominal or thoracic tumor, and direct readings in biological, not physical units be obtained with it. Such an instrument could be calibrated with a standard biological material.

It cannot as yet be considered absolutely settled that equal ionization doses are equally effective, no matter what the wave length of the x-ray.

The nearest approach to the biological standard now in use is the erythema dose. This dose varies with the individual and also with the portion of the body. Once obtained it is reproducible with the same x-ray apparatus under exactly the same working conditions, but each machine must be checked up upon a human being.

In the Crocker laboratories standardization is accomplished by means of a certain strain of mouse cancer. The method is recommended to all practicing deep therapy.

It is dangerous to assume that the proper carcinoma dose for human therapy is that resulting in the destruction of a subcutaneous metastatic nodule from carcinoma of the breast. Recurrence may occur. Also that cancer cells do not become immune to repeated rayings and inoculations has been proved by experiments with mouse tumor.

Only lympho-sarcoma and basal cell carcinoma are permanently curable with an approximate erythema dose—and they may show resistance.

Conclusions:

As the difference between a stimulating and an inhibiting dose for tumor cells is not very great, likewise that between the dose necessary to kill cancer cells and that which may cause serious injury or even death of the patient, it is extremely difficult to properly calibrate an x-ray machine for deep therapy.

Exact surface and depth dosage is therefore a necessary preliminary to deep therapy.

The mouse tumor (Crocker Fund No. 180) has shown no variation in its x-ray lethal dose during five years of study and furnishes the best means of calibration.

The lethal dose for this tumor for x-ray of any voltage and any filtration is approximately six erythema doses as measured by a faint redness after ten days on the most sensitive skin areas.

In comparison to human tumors it shows about the same resistance to x-ray as the highly malignant neoplasms of the intestinal tract which as yet evade successful radiotherapy.

The lethal dose for radium for this tumor being also known, it furnishes the means for biological comparison between the action of x-ray and radium and permits the estimation of equivalent dosage.

X-ray Studies of Mediastinal Shadows With Special Reference to Dermoid Cyst. By Max Kahn, M. D., Baltimore, Md. J. Radiol. Feb. 1922.

NEOPLASM is not infrequently found in the mediastinum. Aneurysm may be mistaken for it. Fibromata, chondromata and lipomata may be found but have never been demonstrated roentgenologically. Sarcoma is

more common than carcinoma. Metastasis frequently follows malignant sarcoma of the bone and may follow other types.

Primary carcinoma of the mediastinum arises from the mucous membrane of the esophagus or trachea, rarely from remains of the thymus. It may occupy one or both sides and often involves the lung and pleura. It is difficult to distinguish roentgenologically between primary and metastatic carcinoma, however, the shadows in the latter are usually more regular in outline.

Aneurysm may be distinguished by noting the expansile pulsation though care must be taken not to confuse a normal pulsation transmitted to adjacent parts.

Hodgkin's disease cannot be absolutely differentiated from lymphosarcoma by the mediastinal shadows.

Enlarged thymus may be manifested by a shadow in the anterior mediastinum.

Roentgenologically a mediastinal abscess has usually a sharply defined border, is fairly large, shadows are not as dense as neoplasm and no pulsation is visible.

Echinococcus cyst is very rare but may be present commonly in the right side in the region of the base, may be attached to the diaphragm, extending upward from the liver.

Dermoid cysts in the mediastinum vary in size from a walnut to that of a child's head, are usually spherical in shape but may be flattened.

Detailed report is made of a case of dermoid cyst of the mediastinum in a female patient fourteen years of age. Symptoms had appeared about four weeks previous to the examination. A dull pain and a swelling were noticed at the upper part of the sternum. Cough had been present for a week. No other very marked pathology was shown.

Roentgenoscopic examination showed a large rounded tumor shadow occupying the greater two-thirds of the right side of the chest. This shadow moved freely upon inspiration and revealed lung structure posteriorly and below. The liver shadow appeared depressed. It apparently was slightly attached to the diaphragm near the median line. No pulsation could be seen in that region. Upper right lobe and apex appeared clear and left lung also. Heart shadow was displaced well toward the left, the heart was slightly enlarged apparently and there was a marked gradual curving of the dorsal spine backward. This tumor shadow was thought to be due to a large dermoid cyst through an echinococcus cyst was considered also.

Operation was performed by Dr. Bloodgood. A cyst was found and opened; it contained thick yellow pus, granular debris and hair. Diagnosis: dermoid cyst. It rested upon the diaphragm and was slightly adherent to it; there were a few adhesions to the lung to the outer side and above the cyst. The larger portion of the cyst under the mediastinum could not be separated from the pericardium and the operation was abandoned after suturing a Brewer tube into the cyst. Drainage was rather free but post-operative course was unfavorable, pneumonia of the right lung developed and the patient died the third day after operation.

Post mortem showed that the cyst had occupied practically the entire space of the right lung, pushing it up into a very small space. The cyst extended from the mediastinum to the liver, to the chest wall and almost to the clavicle. It was very adherent in the region of the clavicle and so firmly attached in the mediastinum that it was not possible to separate it with the gloved hand. It contained a tumor mass about the size of an orange, irregular in outline, spongy, pinkish white, covered with short fine hair. Section studied microscopically showed an epithelial covering with hair follicles, sebaceous glands, sweat glands and hair follicles, below was subcutaneous tissue and fat. The cyst wall was

composed of dense fibrous tissue with no evidence of epithelial lining.

The cyst enclosing the tumor probably represented a reaction of the body in walling off the original dermoid tumor.

This case had received seven radium treatments during the time preceding operation. Dr. Bloodgood, in discussing the case stated that he believed it had been a mistake to operate so soon after radiation, also that failure to get a reduction in the shadow showed the lesion was not amenable to radiation and that the second radiation should not have given. He also stated that, though it might be a question whether the operation was a mistake, he had as far as possible used previous experience in deciding upon it.

Dr. Bloodgood also stated that in case of a mediastinal shadow radiation should be given irrespective of previous history and in a great majority of cases reduction of the shadow would follow which would indicate sarcoma as mediastinal tumor does not show this reduction. In the case operated Dr. Bloodgood had felt that it was unquestionably a case of carcinoma.

The Possibilities of Pneumoperitoneum in Gastro-intestinal Diagnosis. By L. R. Sante, M. D., St. Louis, Mo. *J. Radiol.*, Feb., 1922.

THERE is no question of the efficaciousness of the present method of gastro-intestinal diagnosis. The problem is to detect where this method is weak and to determine whether pneumoperitoneum will be of aid.

Barium meal utilizes a medium of increased density while in pneumoperitoneum a medium of decreased density is employed, namely, gas. The use of the former in cancer in cases where lesions are present in the anterior or posterior wall of the stomach often fails to reveal the pathology.

In examination by pneumoperitoneum the stomach must be perfectly empty. It is wise to wash it out. The abdomen is then cleansed and painted with iodine and pneumoperitoneum is produced by inserting a lumbar puncture needle into the left lower quadrant. No attempt is made to sterilize or filter the air. Deflation at the end of the examination should be the established routine.

The patient, lying on his back, is examined before a vertical fluoroscope. The anterior stomach wall will be seen and also the peristaltic waves originating at the cardiac end and passing toward the pylorus. When the patient is rolled slightly to the left the pyloric ring and the first part of the duodenum can usually be seen.

On examination with the horizontal fluoroscope the stomach casts a shadow similar to the postero-anterior view shown by the barium meal examination. The use of barium meal in connection with pneumoperitoneum however is not of advantage.

In demonstrating tumors of the posterior wall of the stomach the patient must assume a prone position and be supported by a block beneath the head and also one under the thighs to allow the abdominal walls to sag forward thus rendering the retroperitoneal structures visible. The vertical part of the stomach can be seen extending almost obliquely downward while the transverse portion bulges backward into the prevertebral space. The second and third portions of the duodenum may be rendered visible and diverticula should be easily localized. Tumors of the head of the pancreas can be shown in their relation to the duodenum but not better than in the barium meal examination.

Adhesions of the small intestines to the surrounding organs and to the abdominal wall are the most important lesions demonstrated by pneumoperitoneum. Intestinal obstruction, the result of old adhesions, does not show any better by this method but inflammatory lesions, the result of sub-acute peritonitis, are

easily recognized by this method since the intestines will be seen to be fixed—movement on the part of the patient not displacing them as normally would take place. No deleterious effects are noticeable in such cases following the use of this method.

The contents of hernia can usually be established without difficulty—either a gas filled hollow viscera will show or dense omental tissue. Excellent information is secured in cases of suspected malignancy, also in regard to the portion of the stomach involved in the hernia.

The normal appearance of the large bowel and the wide variation in movement of the cecum in different individuals must be kept in mind when making their examination. True pericecal adhesions can be distinguished from normal attachments of the cecum by the fact that any change of position which puts them on a stretch will cause distinct pain. In determining the extent of infiltration of carcinoma of the large bowel pneumoperitoneum is of great advantage but it cannot be used for detection of the primary growth.

There are still possibilities in this method which are as yet not worked out.

The Roentgen Ray in Uterine Fibroids: Practical Deductions from One Hundred Consecutive Cases. By Mary Elizabeth Hanks, M. D., Chicago, Ill.

DR. Hanks cites facts to show the similarity between the changes attending the normal menopause and those attending the artificial x-ray menopause. Edema of the endothelial lining of the capillaries is produced; ovarian stimulation is inhibited, the ripe and ripening graafian follicles being first affected, then the primordial follicles and last the interstitial tissue. If all follicles are destroyed amenorrhea will persist and the uterus will atrophy. The internal secretions of the ovary are not interfered with at all. The interstitial tissue of the ovary is the last to be affected and probably escapes with full functioning powers. It is an important source of ovarian endocrines.

The risks of failure in roentgen ray treatment of properly selected cases is so small as to be negligible.

The size of the tumors treated varies from the very small to that the size of a full term pregnancy. The indurated, non-vascular, fibrous tumor with no history of hemorrhage recedes slowly and gives least satisfactory results.

The most favorable age is forty years or older.

That certain associated pathology is a contra-indication to x-ray is not true as the author's experience proves. Prompt healing in cases of erosion of the cervix uteri has taken place under roentgen ray treatment. Follicular cysts have been much improved. X-ray reduces the typical fibroid but never reduces the large ovarian tumor. Hemorrhage has been controlled in ninety-nine per cent of the cases.

The importance of an examination exactly locating the tumor and estimating the pelvic condition in general is primary. There must be thorough systematic raying beyond the time when menstruation ceases. Twelve series extending over two years is the most the author has given. The average operator is too casual in his diagnosis, technique and general conduct of the case, especially in his estimation of end-results. A follow up system is essential for best results.

The author's first thirty consecutive cases show today fully eighty per cent without demonstrable tumors. The great majority of those who still have demonstrable tumors are "symptomatically cured", i. e., the patient is not conscious of its presence, it is freely movable and the menopause is established. Of the remaining cases two very large tumors have been much reduced in size and symptoms very largely remedied. One case had to be

operated because of gonorrheal infection. One case had a myxomyoma and is interesting because conception took place after x-ray treatment. One case has died of heart disease, two discontinued treatment too soon, two cannot be traced and three are still problematical. No case has developed malignancy. The fear of sarcomatous transformation is not based on logical reasoning and authority is cited to support this view.

The technique employed is the cross fire method, using the Coolidge tube, nine inch spark gap, seven inch skin distance, five milliamperes and four to seven minute exposure. One large single dose is not favored by the author.

Deviations at the lumbo-sacral and the sacro-iliac joints were present in many of the cases treated and the author is inclined to consider that this may be an etiological factor and is convinced that recovery is slower and some symptoms more severe because of this interference.

X-ray has been preferred to radium because it works more slowly, reduces the larger tumors more successfully, and can be applied without loss of time, inconvenience or discomfort—also the danger is negative from roentgen rays. Intra-uterine application of radium may produce serious results.

Thousands of women are still undergoing operation without being offered the information to which they are entitled about the roentgen ray.

Foreign Body in Eye and Orbit Located by Fluoroscope. By E. Bradford Burwell, M. D., Aberdeen, Wash. *Northwest Med. Dec.*, 1921, p. 344.

IN locating a foreign body in the eye the important point to determine is whether the body is in the globe or has passed through into the orbit.

The case reported had been injured while hammering on steel. The wound of entrance was in the upper lid, about five mm. long, through the ciliary region, upper temporal quadrant, left eye. Outer half of fundus was obscured by blood and there was much pain upon movement of the eye.

The x-ray showed a large piece of steel far back and a little to the temporal side. All efforts to remove it failed, even with the point of a giant magnet. A second x-ray showed it still in the same location as before.

To determine whether the foreign body was in the globe or the orbit the fluoroscope was employed. On account of the density of tissue the anterior view showed nothing. A lateral view showed the steel very distinctly and upon movement of the eye up and down the steel was seen to make wide excursions in the opposite direction proving that the body was partly in the globe and partly in the sclera. This diagnosis was proved at operation.

The Combined Use of X-ray and Radium in the Treatment of Malignant Disease. By James J. Clark, M. D., J. M. A. Georgia, Dec., 1921, p. 839.

THE improvement in the x-ray tube, which permits of control and the use of greater dosage, together with the use of more powerful apparatus and thick filters has so improved the technique of x-ray therapy that it is upon the same footing as radium in the treatment of malignant disease.

Both these agents may be employed together or separately.

Results obtained in the treatment of fibromyomata compare very favorably with those obtained from operative measures and for malignant disease of the pelvic organs, if at all advanced, radiation therapy has as favorable a prospect as operative measures though recurrence is as apt to occur with one as the other. Operations should be as radical as possible when performed and radiation employed before and after operation.

All post-operative cancer should receive prophylactic treatment immediately after operation and at intervals for at least a year. A number of such cases have been under observation for several years without recurrence. No inoperable case should be refused a trial of x-ray or radium, for results are beneficial even in some of the most hopeless cases.

By the use of hard tubes and longer exposures effects of quite marked degree can be produced as deep as ten cm. (four inches). The same results may be secured from the use of radio-active bodies, if the quantities are large and the time of exposure prolonged but this may be dangerous while with the x-rays a measure of safety can be obtained by working at a greater distance from the skin.

The quality of the ray can be kept at a fairly constant value and the quantity to administer is the question. With a growth at a depth of two centimeters three hundred to five hundred X may be necessary to cause a retrograde change in the cancer cells. The maximum depth in any part of the body may be taken to be ten cm.

With heavy doses of penetrating rays the following points must be observed: employment of heavy filters, proper skin distances, many portals of entry, and sufficiently long intervals between exposures.

The histologic action of radium and x-ray on the cells is as follows: an edema of the endothelial lining of the blood vessels to the extent of occluding the small arteries, thus shutting off nutrition. Further treatment produces an endarteritis obliterans in the small capillaries. The effect on the cells is first a cloudiness of the nuclei, then disappearance of the entire cells and replacement by connective tissue growth.

In deep seated growths multiple areas must be treated so that the growth receives heavy dosage while the skin receives only one skin unit.

The question is raised whether all cases treated by x-ray should not later be operated in order to remove any possible buried focus and it is stated as an indisputable fact that pre- and post-operative radiation in any form of cancer is the correct procedure.

In the present state of knowledge of therapeutic radiation preference must be given to early operative treatment followed by the x-ray.

After a thorough course of treatment the patient should come back for inspection, and for treatment if necessary, for two or three years. Other methods of treatment should not be neglected. Pfahler advises the use of thyroid extract as assisting in tissue metabolism.

The end result in treating malignancy depends upon approaching it with proper knowledge of the amount of radiation required and proper administration of this dosage.

Radium Treatment of Carcinoma of the Bladder. By Benjamin S. Barringer, M. D., N. Y. *Annals of Surgery*, Dec., 1921, p. 751.

THE treatment of carcinoma of the bladder at the Memorial Hospital of New York has been divided into two periods, the one previous to June, 1919 when radium was applied through the urethra without opening up the bladder, and the other, since that time, when intraurethral treatment plus the application of radium after opening the bladder suprapubically is used. The latter form of treatment was resorted to to destroy extensive bladder carcinomata which the first method of treatment did not reach. The cases treated covered a period of nearly five and one-half years. There were one hundred and forty-two cases of advanced carcinoma, four cases of small carcinoma, nine cases of extensive papilloma and two borderline cases.

Most patients with carcinoma of the bladder have had symptoms for a year or longer but

they have not considered them as serious. Loss of weight and strength is not so frequent a symptom in this type of carcinoma as in others and appears late in the history of the case. Pain down the leg is a very rare symptom in these cases. Out of one hundred and thirty-eight cases haematuria was the first symptom in seventy and the second symptom in sixty, and did not appear in eight. Disturbance of urination was the first symptom in fifty-eight cases out of one hundred and sixteen and the second symptom in fifty-two of the others.

The author believes that many bladder tumors run true to their original histological structure but malignant degeneration may occur in a papilloma. Extensive tumors of the red papillary type should be regarded with suspicion. The more a tumor tends to a flat type the more malignant it is.

The cystogram is made after the empty bladder has been blown up with air until the point of discomfort is reached. The operative findings in most cases have corresponded accurately with the radiographic findings. The cystogram will not however show the pedicle of a pedunculated tumor.

If the tumor is confined to the bladder it may be suitable for radiation. Infiltrated, indurated, extensive, and highly malignant carcinomata have been removed though not successfully in all cases.

Radium fairly consistently controls haematuria even though the tumor may have gone beyond the bladder.

The author believes the use of radium in hopeless cases is not advisable because it is oftener followed by failure than success as a palliative measure.

Papillary carcinoma can be destroyed by surface radiation by using large screened doses. Indurated carcinoma are best destroyed by implanting small bare tubes of radium into the base of the tumor throughout the indurated area and leaving them there. It is possible to miss some carcinomatous area in using these, therefore, screened radium in the surface is employed in conjunction with the tubes in the depth.

Intravesical treatment is used for growths confined to and around the bladder neck, for papillomata, pedunculated papillary carcinoma if the pedicle can be reached, and for infiltrating sessile growths of not more than two centimeters in diameter.

Suprapubic methods are used for growths other than those mentioned above if they are without metastasis. Extensive infiltration of the bladder wall, large and multiple tumors are the indication for section, to which all doubtful cases are submitted.

Gas and oxygen anesthesia are used in the suprapubic method. A long incision is made and indurated parts of the tumor are implanted with radium bare tubes placed within a quarter of a centimeter of the edge of the tumor. Surface radiation is accomplished by means of tubes of screened radium.

Carcinoma of the bladder has been removed in eleven cases by the intravesical method. The longest case has gone four years and four months without recurrence.

To January, 1921 twenty-nine cases of carcinoma have been operated by the suprapubic method. There were no direct deaths though one died seven weeks after operation and one other two months after. Some showed such extensive carcinoma that no radium treatment was even attempted. In ten of these the growth was removed from the bladder, the longest case having gone twenty months post-operation with a bladder clean of tumor. Five have not been cytoscoped since operation. The remaining fourteen are dead or doing badly. There has been but one implantation of tumor in the operative wound and this case had been previously operated elsewhere.

Radiotherapy of Malignant Tumors. Charles Goosmann, M. D.

THE experience of the recent years gives the radiologist good "reason for the hope that is in him."

Cancer of the skin is usually of the basal cell or rodent ulcer type and permanent cure may be expected in ninety per cent of cases, although some cases of long standing, and those which have had improper treatment, are as a rule hopeless.

Epithelial tumors containing so-called pearls are less common than the above form. These are often called prickly cell cancers. They may occur on the lips, tongue, esophagus or the vaginal mucous membrane. Radiotherapy in cancer of the lip and of the vaginal walls gives good results but in the other types the results are frequently disappointing. These types are apt to spread to the lymph nodes and in such cases must be dissected out and x-ray treatment given the area of drainage as radium is less useful owing to the large area.

Glandular structures are involved in malignant adenoma, adenocarcinoma, medullary and scirrus cancers. In these radiotherapy is indicated in inoperable mammary and rectal cases and in recurrence. Treatment of operable cases by the x-ray may be justifiable in the near future but is not at the present. In prostatic cancer radium is preferable to any other mode of treatment but tumors of the bladder present a discouraging problem.

In operable cancer of the uterus radium holds out a degree of hope, in fact the percentage of cures is relatively large. The question is whether in early and operable cases radiotherapy or operation is better. The author believes radiotherapy is the more desirable and backs this with competent opinions from abroad as well as here.

Of the sarcoma the round celled is most responsive to x-ray and radium while osteosarcoma and chondrosarcoma are the ones least influenced.

The end results in mediastinal sarcoma have not been good but improved technique will bring happier results.

Good results have been secured in the treatment of cellular carcinoma of the testicle and the ovaries and in mixed tumors of the parotid. Tumors of the antrum and hypophysis are benefited and sometimes cured with combined x-ray and radium. Acromegaly has also shown improvement.

The New X-Ray Therapy. By Charles Goosmann, M. D.

MANY questions have been asked about the German methods of deep x-ray treatment, hence this paper.

Deep x-ray therapy was ridiculed upon its first appearance. With perhaps as little logic results claimed by the German workers are now being ridiculed.

Expressed in terms of peak voltages there is not so much difference between the German and the American technique. It is probable that penetration continues to increase with voltages higher even than 200,000. There are some German installations which give 250,000 volts and some American machines with a maximum of 280,000. The higher voltages are desirable if only to reduce the duration of treatments but besides this these voltages will increase the percentages of rays that reach a deep seated lesion and so lessen the damage to the skin. Kronig and Friedrich are quoted to prove that filtered gamma rays of radium and mesothorium, the only ones used in deep therapy, have a penetrating power not remotely approximated by x-rays.

X-rays are produced in a small area called the target and spread in all directions. A long target distance would give a better deep effect but is not practicable because of the length of treatment then requisite.

ABSTRACTS AND REVIEWS

The area through which the x-rays are directed through the skin toward the deep seated lesion is called the portal of entry. A large portal of entry gives an increased depth dose due to the secondary rays produced in the tissues illustrated by the phenomenon of visible light scattered in passing through milk.

X-ray tubes produce a mixture of hard and soft tubes, the latter if absorbed in the skin cause severe reactions and so filtration was resorted to to bar them out. However, to secure truly homogeneous rays requires such filtration as increases the length of treatment out of all proportion to the practical benefit procured and therefore approximate homogeneity is all that may be used.

One milliamper of current requires five times as long for a given dose as five milliamperes.

Duration of treatment depends upon voltage, target distance, milliamperage and filtration used. If the patient receives all treatment within a period of one day extreme illness may be the result; if too long an interval intervenes the total dose is rendered ineffective. Treatments concentrated within a period of four days seem to be the best. A proper combination of these five factors constitutes a treatment method.

The Albers-Schönberg method used a 38 cm. target with portal of entry of 13 to 20 cm diameter and leather filter. Gauss and Lemboke reduced the target to skin distance to 20 cm with 3 mm. aluminum filter. They used sometimes as many as thirty-six areas on the abdomen alone. The next improvement was made possible by an American invention, the Coolidge tube, which gives hard rays of constant quality and practically unlimited amount. Heavier filters and longer target skin distances were made possible by the Coolidge tube and the Seilard ionization measurement of x-ray dosage permitted more accurate experiments. Kronig and Friedrich are given particular credit for the newer technique of using a copper filter, long target distance and large portal of entry.

The German technique is not as yet crystallized. The target to skin distance varies from 23 to 70 cm. For filtration one-half to one and one-half mm. of copper is the favorite, though some use is made of one-half mm. zinc and 10 mm. of aluminum. The size of the treatment area varies also, small areas being less used. The author believes the technique of the near future will include long target distance, copper filtration and large portal of entry.

"Roentgen-Wertheim" is the name applied to the new method of treatment of uterine cancer. The bad effects, so marked as to call for a blood transfusion at times, can be mitigated, the author thinks, by spreading the treatment over a period of three or four days though this method is not approved by some of the German writers.

The claims for the new x-ray treatment (which is frequently combined with radium) can best be expressed by saying that there is a tendency to consider cancer of the breast and uterus, and sarcoma in any part of the body, as giving a higher percentage of cures from this treatment than from surgical treatment. Some American surgeons have practically abandoned operation in favor of radium in treating cancer of the uterus.

X-ray Therapy in Tuberculosis of the Testicles and Epididymis. Leopold Freund, Wiener Klin. W. 42, 1921.

THE good results obtained in the treatment of tuberculosis of bones and joints with x-rays, lead the author to study the influence of the treatment on tuberculosis of the testicles and epididymis.

Fifteen cases were under observation for about seven years. Unfortunately the author's cases were quite advanced. All had discharging sinuses, and the lesions had extended to

the vas, seminal vesicles, and the bladder. Some had tuberculosis of the kidney, and it was difficult to tell whether the disease was ascending or descending. Others had tuberculous lesions elsewhere.

In three cases in which the disease was limited to the testicle and epididymis the author met with marked success. In cases where the lesion had extended further the author succeeded in arresting the disease, closing sinuses, and preventing extension of the disease to the other testicle.

As the desired objective was to bring about a fibrosis of the diseased tissue, small and frequently repeated doses were used, viz., one and one-half milliamperes, five to six BW (spark gap) hardness, twenty cm. skin target distance, and six minutes duration. This dose was repeated daily for fourteen days, and the course repeated again in four to six weeks.

The author combined the x-ray treatment with general therapeutic measures, and even with surgical measures in particularly suitable cases.

A. M. P.

The Use of Collargol and Pylon in Pyelography. E. Pflaumer, Zentralbl. f. Chir. Nr. 44, 1921.

THE author observed a number of cases in which the use of colloidal solutions (collargol, pylon) in pyelography resulted in very alarming manifestations. In two cases where the kidney was extirpated in less than twelve hours after the injection of the fluid, a microscopic examination showed that the collargol had penetrated the urinary tubules and the glomeruli causing severe necrotic changes.

According to the author the damaging effects of the colloidal solutions are due mainly to their tendency to diffuse all through the kidney substance, and this tendency is brought about by the following conditions:

1. The physical properties of the colloidal solutions.—On account of their very slight surface tension they easily enter even very minute openings, the coagulability and the greater confluency of the colloids enhance this tendency.
2. The position and structure of the kidney.—By various muscular movements the kidney is alternately compressed and relaxed, producing a negative pressure, thus sucking the fluid into the finer tubules, and as the kidney undergoing pyelographic examination is usually damaged by long standing disease, the valvular arrangement of the tubules cannot prevail against this sucking movement.
3. Other influences such as body warmth, fine shaking movements produced by intra-renal pulsation of blood vessels, and the presence of the roentgen light rays, all tend to bring about a more thorough diffusion of the colloid in the kidney's substance.

The author concludes that none of the colloidal solutions should be used for pyelography. He advocates the use of potassium iodide solution, which if freshly prepared before use will not cause any pain, as the pain is usually due to liberation of free iodine in the older solution.

A. M. P.

Roentgen Therapy in Pruritus Vulvae. Otto Schlein, Zentralbl. f. Gynaekol. Nr. 44, 1921.

THE author discusses at great length the often unappreciated gravity of the disease, which on account of the necessity of frequent scratching, keeps the patient in loneliness, and often leads to suicidal tendencies or to insanity. He then emphasizes the necessity to study every case and determine whether the pruritus is secondary to some underlying disease such as diabetes, nephritis, caused by irritative secretions in genito-urinary abnormalities, or is primary, idiopathic in nature.

The author then reviews the various therapeutic measures employed in the treatment of

this disease. He enumerates a rather long list of general and local sedatives and antipruritics. He discusses the uses of injection into the sacral canal of Schleich's solution, ultra violet rays, and alpine sun lamp, as well as surgical interference in sectioning the perineal nerve. Most of these treatments were effective only in a few light cases, chiefly affording temporary relief.

He then cites a series of eleven cases treated with x-rays observed in the Bardeleben Polyclinic. All cases were, as far as could be determined by a thorough study, idiopathic in nature, about the climacteric, and very resistant to every other treatment. Complete cures were obtained in all cases.

The technique was rather simple. A hard tube of ten to 12 Wehnelt, three mm. aluminum filter, twice a week of one-half erythema dose each time, until ten to fifteen treatments were administered. Only two cases of the eleven required a repetition of the course, and one case required three courses before a complete cure was established. Some cases received local applications of astringent douches along with the x-ray treatment.

A. M. P.

Serial Roentgenograms in the Determination of Healing Processes of Lesions in Pulmonary Tuberculosis. G. Liebermeister, Deut. Med. Wochenschr. Nr. 33, 1921.

THE author points out that in determining the progress of a lesion in pulmonary tuberculosis, only those plates may be used for comparison which had been obtained under an identical technique. Slight variations in technique bring about great changes in shadows so that previously faint shadows may appear strongly fibrotic, while previously dense shadows may appear very faint.

The author found that very slight changes in hardness of the tube, in length of exposure, in quality of the rays, and in the sensitiveness of the plate, were often sources of error.

To eliminate these errors the author uses a test stripe, a piece of material made from particles of metal, bone, and leather. This test stripe accompanies every one of the serial plates and is placed in the same relation to the tube in all of them. Only those plates are used for comparison in which the shadows of the test stripe appear to be alike in density.

The author also calls attention to the fact that the changes in the density of the shadows will occur in recent hemorrhages, and in loss or gain of flesh, factors which must be considered in the interpretation of these plates.

A. M. P.

Changes in the Appearance of the Contrast Shadow of the Urinary Bladder in Patent Hernial Apertures. Segalizer, Mitt. d. Grenz. d. Med. u. Chir. 34 h. 1.

OBSERVATIONS on the bladder in cadavers show that a bladder filled with about one hundred cc. fluid covers both internal abdominal rings of the inguinal canals. In life due to intra-abdominal pressure, the filled bladder assumes the shape as allowed by its neighboring structures. It is therefore natural that in the enlargement of the internal abdominal rings, or in widely open crural rings, the intra-abdominal pressure will force those portions of the bladder wall overlying such apertures to enter them, that being the line of least resistance. This explains why the bladder is so frequently found in hernial openings.

The author demonstrated the presence of portions of the bladder in these apertures by filling it with one hundred cc. of a seven per cent potassium iodide solution and making cystograms in at least three different positions, viz., antero-posterior, purely lateral, and the axial position.

The antero-posterior position shows projections of portions of the bladder into the crural rings in femoral hernia. The purely

ABSTRACTS AND REVIEWS

lateral and axial positions show projections of the bladder into one or both of the inguinal canals.

The author was also able to demonstrate similar conditions in cases of ventral hernia.

Based upon his studies the author advises to empty the bladder completely before operation for hernia, and in a large hernia it may be necessary for the surgeon to determine beforehand the presence or absence of bladder parts in the hernial aperture. A. M. P.

Action of X-rays on Mitosis of Carcinomatous Tissue and Upon the Blood Vessels. Albert Reichhold, Muench. Med. W. Jg. 68, 28, 1921.

EXAMINATION was carried out in five cases of cancrroids of the lip before, shortly after irradiation, and a long time after irradiation. Only one hundred x was given. The cancrroids disappeared by the treatment. Immediately before and after irradiation tissue sections showed numerous regular mitotic figures. About ten to fifteen to a square millimeter, with regular markings of the nucleus and granules. In the section taken four days after irradiation the chromatin bodies were broken down and scattered irregularly throughout the cell. The mitotic figures were entirely irregular. The nuclei would not stain, and cells appeared decomposed. A rich vascularization was also observed so that it gave the appearance of a cavernous structure. The endothelial cells were compressed and cubical in form.

A. M. P.

Roentgenological Differentiation Between Cardiac Hypertrophy and Cardiac Dilation. H. Dietlen, Zentralbl. f. Gef. u. Herz Kramkh. Nr. 44, 1921.

AFTER a lengthy discussion of the physiology in either of the two conditions and their clinical manifestations the author pointed out the following observations from which a roentgenological differentiation can be made:

The hypertrophied heart shows a marked arching of its borders, especially that of the left ventricle, and the apex. If the right heart is also hypertrophied, its border also shows marked arching. The whole heart may thus be designated as the round heart. Such a heart is spherical in shape. The arches formed by the ventricles and auricles are definitely delimited from the arch formed by the great vessels.

The heart contractions are of larger excursions and time of systole is short.

The hypertrophied heart is rather constant in form, does not change much with position, nor is it influenced by changes in the intrathoracic pressure.

The dilated heart has a less definite form than the normal. Sometimes only one particular portion is dilated. In a generally dilated heart it appears wide, stretched, and lies on the diaphragm, the right cardio-phrenic angle being enlarged. There is a diminished constancy in form, so that the form of the

heart varies with changes in the intrathoracic pressure, also with changes in position and weight. It becomes smaller on inspiration and larger on expiration. The contractions are of small amplitude, and the time of diastole is short. A. M. P.

The Heart in Healthy and Sick Infants as Determined by Roentgenoscopy. Lange and Feldman, Deut. Med. W. 47, 960, 1921.

THE authors observed heart shadows by roentgenoscopy in one hundred and fifty healthy and sick infants. Healthy infants showed a relatively large heart. Infants with exudative diathesis showed enlargement above the normal in fifty-five per cent of the cases, while in cases of acute or chronic digestive disturbances, as well as in other cases of malnutrition the heart was smaller than normal.

The authors used the technique described by Altstaedt. The infant being placed under the fluoroscopic screen the transverse diameter of the chest in its greatest expansion is obtained, likewise the transverse diameter of the heart in diastole. The quotient of the transverse diameter of the heart over the transverse diameter of the chest (Tr. diam. heart—Tr. diam. chest) should normally equal one to one and nine-tenths or one to two. A quotient of one to one and seven-tenths was considered an abnormally enlarged heart and one to two and five-tenths an abnormally small heart.

A. M. P.

